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THE OCCURRENCE OF FACIAL PARALYSIS AND METHODS FOR ITS CORRECTION.

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To determine the method which must be selected when one is considering the operative intervention in facial paralysis, one has to investigate the question of its origin. We know that in the so-called rheumatic paresis (Bell's palsy), a complete or almost complete restoration of function may, with all probability, be expected, and we may rely upon applications of heat and electrical treatment. If we are dealing with a severe paralysis which does not show early signs of improvement, we are agreed today that it is advisable to expose the facial canal from the second knee to the stylomastoid foramen, and to split the nerve sheath. The same procedure is indicated when a facial paralysis develops during the course of an acute mastoiditis, and the careful exposure and exenteration of all diseased cells brings no prompt improvement in the symptoms. Under such conditions also, the exposure of the facial nerve, after the splitting of the sheath, usually results in recovery of the nerve.

The procedure in cases of injuries to the facial nerve is quite different. When such a case was presented to me formerly, I first fully exposed the nerve in the injured area, and after extensive mobilization of the nerve united the portions by suture. In order to protect the nerve from every

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possible injury, I formed a subcutaneous periosteal flap and placed it on it. I expected that the direct nerve suture would be the ideal method of producing good results. Unfortunately, in none of the cases could I obtain the desired success. Of course, I never had the opportunity to perform this nerve suture immediately after the accident; the earliest chance having been about one year after it.

The earlier method employing a nerve plug from the nervus accessorius or hypoglossus which I repeatedly carried out also failed to give me a satisfactory result. Although the operation as such was quite successful, none of my patients was ever in a position to produce independent motions even after years of practice, the facial nerve functioning only with associated motions of the shoulder.

After these experiences of mine with the nerve suture and the nerve plug, I was astonished to find that Duel, following the idea of Balance, was able to obtain nearly a complete restoration of function of the facial nerve in a large series of cases. Balance, as is known, being the first to suggest the nerve plug, now was again the first to recommend the free transplantation of a piece of the nervus cutaneus femoris into the defect of the facial nerve. There can today be no doubt but that an operation performed according to the method of Balance and Duel, in good time can give an almost ideal result, with only the frontalis muscle not functioning, peculiar as it may seem. It is astounding that Duel describes, in several cases, an almost complete success, even though a suppuration had occurred.

The advance made in this field, as a result of the years of research by both of these scientists, is of greatest value. I myself saw excellent results from free nerve transplantation performed by Dr. Tickle.

Unfortunately, the method of Balance and Duel is not indicated in all cases. It cannot be successful in cases where the paralysis has already been of long standing, sufficient to cause a degeneration of the facialis fibres. Here a nerve transplant is just as useless as in cases of severe destruction following, for instance, gunshot injuries. Recently I saw the case of a patient, age 18 years, who, in her second year of life suffered from a rheumatic complete facial paralysis. Naturally, in this case a nerve transplant could be of no use.

Various procedures have been tried on such patients to secure an approximately satisfactory result. The best seemed to be the implantation of strips of facia lata, such as Sheehan has extensively carried out. Naturally, the results are incomplete. A biologic and more practical idea was the muscle plug operation performed by Lexer in 1908, based on Wrede's suggestion. As is known, it is being carried out essentially by implanting portions of the masseter muscle into the angle of the mouth and parts of the temporalis muscle into the musculature of the frontalis and orbicularis oculi. The idea is that these muscle portions by their contraction would tend to elevate and reduce deformity. According to Rosenthal, it was to be expected that the nerves of the implanted muscles would unite with the nerves of the paralyzed muscles and so these muscles would receive new enervation.

Successes reported by Rosenthal and Lexer are noteworthy. As to myself, I have attained fairly satisfactory results with this procedure too. Sheehan has changed this method in that only the temporalis muscle is used as well for the angle of the mouth as for the frontalis and orbicularis oculi. He makes that possible by chiseling through the zygomatic process, whereby he secures an essentially greater motion of the temporalis muscle.

It is a great disadvantage found in both the implantation of the nerve portions into the facial as well as the muscle plug, that after the operation no apparent result occurs for months. If the implantation of the nerve is successful, then the final result is nearly ideal. That is quite different in the transplantation of the muscle. Here the possible result is fairly incomplete. Astonishing, however, is the immediate improvement after the operation or during the operation of the cases shown by Sheehan, which appeared to show excellent results. Sheehan himself admits that these early results do not last, and that the function later is more or less insufficient.

I would believe that here, to some extent, the method of muscle implantation is to blame. Lexer, as well as Rosenthal and Sheehan, employs the temporalis muscle so that its *tendon's attachment at the processus coronoideus serves as base for the functionally used part, and not, as would be more logical according to the natural function, the muscles on the*

planum temporale. The processus coronoideus is not a firm point from which the muscle fibres can work satisfactorily. The natural working of the muscle fibres as well as their innervation must, in this method of implantation, become reversed. If one selects the fibres of the temporalis according to their normal course and separates their corresponding attachment to the processus coronoideus carefully, then one has sufficiently long fibres for the implantation and the nerve course also remains natural. This is, of course, not possible for the angle of the mouth. The fibres of the temporalis muscle are not long enough to be attachable there. Here parts of the masseter muscle have to be used according to Lexer's procedure.

It is quite natural that the patients, after the operation, expect an apparent result as early as possible. And even though one tells them that it will take many months before a good result will be visible, they are only partially satisfied and wait anxiously for the first indication of improvement. We have to realize that even the Balance-Duel method requires from seven to nine months before showing the first results.

In order to achieve an unquestionable early improvement and do away with the deformity at least while the face is not moving, I changed the procedure of the muscle plug operation in such cases not suitable for the Balance-Duel technique.

The method I use in these cases of facial paralysis is a combination of muscle transplantation and face lifting, described as follows: Local anesthesia with $\frac{1}{2}$ per cent novocain, to which is added 8 drops of adrenalin to each ounce. Infiltration of the whole side of the face and the skin behind the ear. An incision is made for the lifting of the cheek and the drooping lower lid in the same manner as Joseph and Madam Noël describe it. The incision begins immediately in front of the ear, about 2 to 3 cm. above the upper edge of the rim of the ear, within the region of the hair. It goes perpendicularly downwards towards the anterior attachment of the auricle, passes close around its edge, but immediately in front of the tragus in the shallow fossa in front of the tragus. Passing downwards, the incision reaches the lobe of the ear, which it encircles, and is led close behind the auricle in the attachment furrow to the hair line. From the starting point of the first incision above the ear a horizontal incision,

approximately one inch long, is made towards the front. From its anterior endpoint an incision is brought downward somewhat in an arc posteriorly, and then parallel to the first incision in about 1½ cm. distance from it. This incision is extended downwards and goes about 2 cm. below the ear lobe and then around it in an arc posteriorly and upwards to unite with the incision behind the ear at its lowest point.

Fig. 1A.

Fig. 1B.

At this phase of the operation it is not advisable to remove any part of the skin there, as same is rather firmly attached to the underlying tissues and will not give much, even after having been carefully detached from same. It is rather advisable to postpone the removal of any part of the skin until the ending of the operation, at which time it can be accurately determined what amount must be removed. At the highest point of the incision a triangular portion of skin must be removed, the base of this triangle lying forwards on this incision and its upper side extending towards the back at right angle to its base, the size of this triangle to be determined at the very end of the operation. Now the skin outlined by the incision in front and below the ear is removed, and the skin is undermined in all directions to a considerable extent. The incision and undermining of skin should go to, but not beyond, the fascia. Upwards the fascia covering the temporalis muscle must be completely exposed.

If necessary, the incision of the skin must be extended upwards.

The fascia of the temporalis muscle is incised, the muscle in its fibre direction exposed, and followed downwards to its attachment. About one-half of this attachment is separated from the processus coronoideus. The easily bleeding vessels found here must be carefully sutured. It is not advisable to use the anterior fibres of the temporalis muscle, but rather the middle ones, as they have sufficient length and are best

Fig. 2A.

Fig. 2B.

suited as the source of energy for the frontalis muscle and orbicularis oculi.

We now expose through the original skin incision the frontalis and orbicularis oculi muscle. The lower lid is then raised in the same manner as one does for "crow's feet" and "tear-sac." Incision is made close to the free edge of the lower lid, beginning about 1 mm. below the lashes at the inner canthus. Laterally, this incision goes to the outer angle of the eye, to the skin furrow running slightly downwards. In this furrow a small incision is made about 1 cm. long, and then from the inner angle of the eye another incision is made which in the middle is about $1\frac{1}{2}$ to 2 mm. from the first, which runs in a slight arc laterally and upwards, and then into the end of the short furrow incision, in which it forms a small triangle with the base upwards and medial.

These incisions, which are routine procedure to the plastic surgeon, can easily be seen on the drawing.

The skin of the lower lid is carefully separated from the orbicularis oculi muscle by undermining it with a short, sharp knife. The slight bleeding is carefully controlled. From the lateral cut the adjacent skin of the upper lid is then undermined and finally the fibres of the frontalis muscle are exposed. Now the tendon of the fairly broad muscle strips of the temporalis are sewn into the frontalis muscle and the orbicularis of the upper and lower lid.

Sheehan, who implants sections of the origin of the temporalis muscle, has enough muscle tissue to lead through the upper and lower lid to the medial angle of the eye. Thereby he obtains the most startling immediate effect which, however, does not seem to last, as he himself says. I believe this is explained by the fact that the *origin* of the muscle was used and not its *attachment*, whereby the natural function of the muscle was reversed. If, in the opinion of Rosenthal, a neurotization of the paralyzed muscle, more than the pull of the implanted muscle, affords the success, then the implantation of the attachment of the temporalis muscle is the only advisable method for the same reason, even if the whole orbicularis oculi is not covered by transplanted muscle. In similar manner, the growth of neurons of the frontalis muscle is stimulated when one inserts a strip of the temporalis muscle into the frontalis, according to its natural course, as only a new revivifying can restore its natural function. Even after the Sheehan method, a substantial restoration of the function of the frontalis muscle through the muscular effect of the implanted temporalis strip is not to be expected.

For the elevation of the angle of the mouth and the restoration of neurotization of the levator anguli oris, I believe we should follow Lexer's procedure of using the masseter muscle, since the fibres of the temporalis, taken from their origin, are not long enough to be inserted in the orbicularis oris muscle.

One proceeds best by an additional incision close underneath the mandible. The anterior palpable masseter edge stays in the middle of the incision. One remembers that here the external maxillary artery is immediately in front of the anterior masseter edge. The masseter edge is exposed

upwards to its origin. Then two strips are cut parallel to its fibres, a smaller one for the levator anguli oris and a broader one for the orbicularis oris, which later is split into two equal parts and fitted into the muscle of the upper and lower angle of the mouth.

I elevate the angle of the mouth immediately. An incision passes from the nasalabialis sulcus correspondent to the natural nasalabial fold bending downwards so that it remains

Fig. 3A.

Fig. 3B.

about $1\frac{1}{2}$ cm. removed from the angle of the mouth (see Fig. B). Somewhat above the angle of the mouth passing from this incision a small short skin triangle is marked out on the cheek posteriorly and excised. Passing from its upper end at the nasal alar the first incision is brought to the nasal opening and from here it goes laterally downwards, thereby demarking a short skin triangle with the base towards the nasal alar. Further downwards, the incision passes in an arc somewhat laterally to the angle of the mouth, going to the end-point of the first incision below, thus forming a crescent skin strip. This skin strip is now removed. The orbicularis oris muscle must be carefully exposed, and care taken not to injure the mouth mucosa, which is easily done. Now, from the angle of the mouth the skin is undermined with a semi-blunt separator till one easily reaches the masseter, whose forward strip has already been separated near to its origin

and is now without any difficulty joined to the levator anguli muscle and into the orbicularis oris of the upper and lower lip.

After all the muscle transplants have been carefully united by chromic catgut, the skin is sutured. First the incision at the lower lid is sewed. Then follows the skin union in front of the ear, lifting the skin upwards at the same time. The skin corresponding to the lowest point of the union is pulled upwards and anchored firmly to the end margin of the ear attachment by subcutaneous suture, using strong

Fig. 4A.

Fig. 4B.

chromic catgut. Some further subcutaneous catgut sutures lift the skin of the cheek upwards. Several skin position sutures unite the wound edges and control the desired elevation of the cheek. One can then, according to one's best judgment, modify the position in order to obtain the best result. The wounds around the ear are sutured, and the skin incisions at the angle of the mouth are united. Position sutures on both small triangles at the wing of the nose and on the middle of the posterior mouth angle incision are made and then the main edges are united. Special attention must be given that the upper mouth angle is elevated in the manner described. The method of suturing depends upon the shape of the nasolabial furrow of the other side. If that is deep then the simple tie is used. If it is flat the scar should not lie deep and then it is advisable to alternate with simple

and mattress sutures. The wound on the end surface of the mandible edge is only partially closed and from here a rubber drain is pushed high into the undermined cheek. It is improbable that this whole operation and skin undermining could be performed without considerable reaction. Also, it is barely possible to avoid slight parenchymatous bleeding. It is best, therefore, not to close the wound completely, but to leave room for drainage.

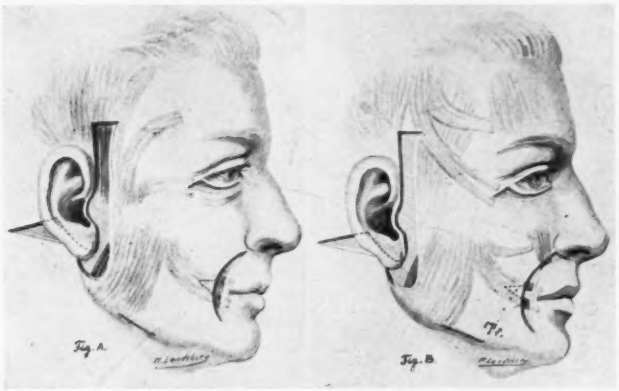

Fig. 1. This figure shows the transplantation of the temporalis muscle stripes as done formerly.
Fig. 2. This figure shows the transplantation which I do now.

A light compressive bandage is made, supporting the skin somewhat upwards. If no strong reaction occurs the bandage is allowed to remain four or five days. Then the drain and most of the sutures are removed, only a few anchor sutures being left in place for another three or four days. As soon as there is no further secretion the wound on the mandible is closed with the three or four mattress-sutures that have already been introduced during the operation.

The success of this procedure is noteworthy. When the reaction and tissue swelling is passed, the patient can see immediately a pleasing improvement. The cheek, the angle of the mouth and the eyelid do not hang down any more. With his face at ease the patient is no longer conspicuous.

There remains to await the success of the muscle implant, which may be helped and encouraged by electrical treatment.

After three to four months there appear the first signs of associated movement of the paralyzed muscles, and gradually the voluntary function is re-established in a more or less satisfactory manner and lasting improvement.

It must, however, be admitted that this operation cannot compete in results with the free nerve transplant, but it has the advantage of immediate definite improvement and is applicable in all cases where nerve transplant cannot be expected to succeed.

I believe that next to the method of Balance and Duel, this procedure will prove useful to those patients who cannot benefit by nerve transplant. Some photos of patients before and a short time after the operation illustrate the results.

667 Madison Avenue.

THE MAXIMUM VALUE OF THE COCHLEAR RESPONSE.*†

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For low values of intensity, the stimulus which initiates the cochlear response has been shown to be nearly proportional to the sound pressure (Covell and Black, '36). There is a departure from this relationship as the intensity is increased and the curve flattens as the maximum value of the response is approached. This limit of the response probably corresponds to the upper limit of hearing intensity. A decrease in the value of the cochlear response results if the intensity is further increased. Attempts to recover the original maximum value are unsuccessful if the intensity of the stimulus has been sufficient to produce a marked rapid decrease in the value. Not only is the value considerably diminished for the frequency of this tone, but for all other frequency tones in the response range.

It has been pointed out (Davis, *et al.*, '37) that caution should be exercised as the maximum value of the response, for a stimulus is approached because of possible damage to the organs of Corti by intense tones. Lurie, '35, has shown that the organs of Corti may become dislodged from the basilar membrane with the use of a sudden and very intense stimulus. Most studies have been made using low intensities of stimulus, such as the intensity of stimulus which produces the minimum detectable value of the response. This level is similar to the one used for audiometric threshold tests in humans. The actual threshold values for the cochlear response have, however, never been satisfactorily determined.

By the use of the voltmeter as an instrument to record values it is possible to approach the maximum and obtain the value for a stimulus without a subsequent decrease. In fact, the procedure can be repeated as often as desired, pro-

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†From the George Williams Hooper Foundation, University of California, and the Electrical Engineering Department, University of California, Berkeley, Cal.

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viding the intensity of the stimulus is carefully controlled. The maximum value is important because: *1.* It is an indication of the capacity of the middle and inner ears to function properly under a load; *2.* an accurately calibrated sound system is not essential since the stimulus need only be increased until the maximum value is obtained; *3.* less amplification is necessary and thus the background noise associated with high amplification is eliminated.

As a means of altering the values of the response, various drugs and chemicals have been applied to the round-window membrane. Similar procedures have been utilized by Fowler and Forbes, '36; Eyster, *et al.*, '37, and others. Their results have been concerned with the changes near the threshold values of the response.

Our data were obtained from a study of the values of the electrical response for 50 cochleae of cats. The results were plotted for those which revealed a maximum response value above 200 microvolts at 1,000 cycles per second. In each instance the electrode was placed upon a small piece of cotton previously soaked in physiological saline solution and in contact with the round-window membrane. The values up to and including maximum were obtained for representative frequencies in the hearing range. It was found that removing and replacing the electrode had very little effect upon the values of the response. This was controlled for several experiments and the number of turns on the screw of the electrode holder were recorded each time. The position and pressure of the electrode were essentially the same for each replacement. Usually only a few minutes elapsed between the application of the agent to the round-window membrane and the recording of the values. Care was taken that none of the substances applied to the membrane reached the middle ear cavity. This was easier to avoid in the cat than in the guinea pig. Following each experiment the head of the animal was perfused with fixative and the temporal bones removed for subsequent sectioning and staining.

RESULTS.

The curves shown in Fig. 1 are characteristic of the values of the cochlear response to a frequency of 1,000 cycles per second as well as changes in these values with the applica-

tion of crystals of magnesium sulphate to the round-window membrane. It is evident that all of the curves have identical shapes. The percentage change in response for any time interval is constant and practically independent of the stimulus.

The manner in which the response changes suggests several ways of recording the change. First the decibel shift in

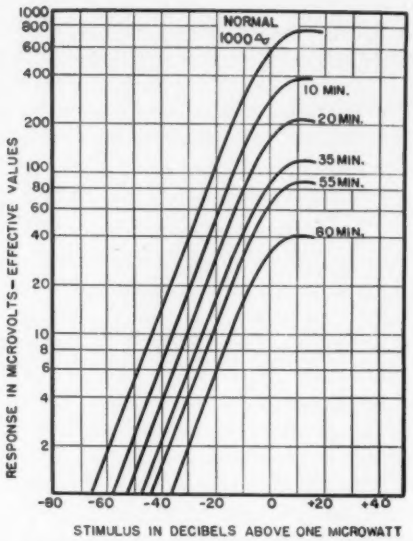

Fig. 1. Cochlear response as a function of the stimulus for various time intervals after the application of magnesium sulphate to the round-window membrane.

stimulus necessary to maintain a constant response value can be taken as a measure of the change in response. An example of this is the adjustment of the stimulus necessary to produce the minimum detectable response. This corresponds to a response of approximately 1 microvolt. If the reference response is 100 microvolts, it is noted from the curves of Fig. 1 that this response cannot be reached following the application of magnesium sulphate after 35 minutes. As the maximum value approaches the reference level, the change as indicated by this method of measurement is greatly exaggerated.

A second method of recording a change in the cochlear response is to express the response value for a given stimulus in terms of percentage of the normal response value. For example, as shown in Fig. 1, the response value for a stimulus of —30 dcb. decreased in ten minutes after the application of the agent from 38 microvolts to 18 microvolts. This represents a relative decrease to approximately 47 per cent of its normal value. The percentage change is the same for

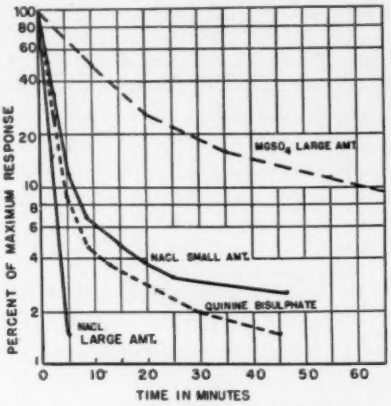

Fig. 2. Values of the maximum response expressed as a percentage of the normal maximum response as a function of the time after application of the agent to the round-window membrane for a tone of 1,000 cycles per second.

any stimulus because of the manner in which the response decreases. Since the minimum measurable response is limited by the noise level, the greatest range of measurements is only possible for the stimulus which elicits the maximum. This second method expresses more fully the manner in which the response changes. It is evident that the constant relation between decibel shift and response value change is not maintained over the curved portions.

Results were obtained for a variety of agents applied in large and small amounts to the round-window membrane. The measurements have been made at various frequencies representative of the audio-frequency band. Expressing the results in curves similar to those of Fig. 1 shows that the rate of decrease of the response varies with the amount of agent used and its properties. The effects of certain of these agents

have been expressed in the form of curves in Fig. 2. The percentages of the maximum normal response values are plotted on a logarithmic scale as a function of the time after the application of each agent. The points on the scale for the first few minutes are located along a straight line. From a study of these curves it is evident that the rate of change of the response at any instant is proportional to the value of the response at that instant. The curves further illustrate that the initial rate of decrease is not the same for all agents and is dependent upon the amount of the material used.

Sodium chloride decreases the response rapidly to an immeasurable value while the change is less rapid when the agent is magnesium sulphate. Although many agents were used in the experiments, the results do not sufficiently contribute additional information. Repetitious experiments using the same agent always gave consistent results.

COMMENTS.

If the hair cells are essential in the production of the cochlear response, the maximum value should reflect the physiological condition of the greater number of these cells. Previous cytopathological studies (Covell, '36) on the effects of quinine and sodium salicylate on the external hair cells revealed a scattering of degenerated cells for the early stages of the drug intoxications. While these changes have not as yet been correlated with the results obtained by the use of the electrical response method, it is possible that changes in the response values would be more apparent for the maximum than for values near threshold.

The application of a readily soluble substance to the round-window membrane involves the consideration of several factors, each of which might cause a decrease in the response values. Polarization of the electrodes is not a factor since the same values were obtained after the material was removed from the round-window membrane, the latter washed with saline solution and the electrode cleaned before being replaced. The difference in osmotic pressures in the cochlear fluids arising from the diffusion of a substance through the round-window membrane may result in collapse or even rupture of the membranes separating the different scalae. Sodium chloride in sufficient concentration was found to cause a rupture of

the basilar and Reissner's membranes in the lower turns of the cochlea. Any agent which resulted in a decrease of the response values did so, first for the high tones, and less rapidly for the low tones.

The predominating factor was found to be the change in conductivity of the cochlear fluids with the ionization of the agent. For comparison the specific conductances of certain electrolytes (International Critical Tables, Vol. 6) were used in the study. A saturated solution of sodium chloride at 25° C. has a specific conductance of 0.251 ohms^{-1} cms.$^{-1}$ Magnesium sulphate in saturated solution at 25° C. has a value of 0.058, ohms^{-1} cms.$^{-1}$ The electrolytic action of sodium chloride is considerably greater than that of magnesium sulphate. The rapid decrease in the response values caused by sodium chloride and the less rapid decrease caused by magnesium sulphate is probably accounted for in this way.

The permeability of the round-window membrane was found to be altered by 95 per cent alcohol, although the response values were only slightly changed. Apparently the alcohol which penetrated into the cochlea was not in sufficient concentration to alter the response values. The application of crystalline agents after treating the membrane with alcohol decreased the values at a slower rate than without so treating it.

REFERENCES.

COVELL, W. P.: A Cytologic Study of the Effects of Drugs on the Cochlea. *Arch. Otolaryngol.*, 23:633-641, 1936.

COVELL, W. P., and BLACK, L. J.: The Cochlear Response As an Index to Hearing. *Amer. Jour. Physiol.*, 116:524-530, 1936.

DAVIS, H.; DWORKIN, S.; LURIE, M. H., and KATZMAN, J.: Symposium. The Neural Mechanism of Hearing. III. Animal Investigations. (a) Behavioral, Electrical and Anatomical Studies of Abnormal Ears. THE LARYNGOSCOPE, 47:435-447, 1937.

EYSTER, J. A. E.; BAST, T. H., and KRASNO, M. R.: Symposium. The Neural Mechanism of Hearing. III. Animal Investigations. (d) The Origin of the Cochlear Potentials. THE LARYNGOSCOPE, 47:461-479, 1937.

FOWLER, JR., E. P., and FORBES, T. W.: Depression in Order of Frequency of the Electrical Cochlear Response of Cats. *Amer. Jour. Physiol.*, 117:24-35, 1936.

LURIE, M. H.: Animal Experimentation on Hearing; Its Clues to the Prevention of Deafness. *Trans. Amer. Acad. of Ophthal. and Otolaryngol.*, 375-389, 1935.

The Medical Centre.

BONY SEQUESTRUM AS A COMPLICATION FOLLOWING MASTOIDECTOMIES.*†

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Many complications in a mastoidectomy can happen postoperatively to prevent a normal recovery. Briefly, diabetes, tuberculosis, lues, erysipelas, anemia, and insufficient operative procedure are well-known causes of a stormy recovery in mastoidectomies. Another serious complication of mastoidectomies may result from bony sequestrum left in the operative wound. A most interesting case of this type was seen in the Otolaryngological Dispensary of the University Hospitals of Cleveland.

Report of the Case: The patient, a white woman, age 22 years, was first seen on June 6, 1936. Having had a profuse discharge from both ears for three months, she was acutely ill. She complained of frequent dizzy spells and attacks of vomiting. For ten hours previous to admission she had noticed dizziness, elevation of temperature, and inability to eat, as well as pain, tenderness, and swelling behind the right ear. The physical examination revealed tenderness, swelling, and redness behind the right ear over the mastoid area, extending well into the zygomatic region. The right external auditory canal was filled with foul-smelling cholesteatomatous discharge. Perforations of both tympanic membranes were observed. The right membrane tympani showed a large perforation involving the entire anterior half of the membrane, which was dull, red, and thickened. The left membrana tympani was also thickened and had a large perforation involving the entire posterior half of the membrane; there was a slight discharge from the perforation. The articulation of the incus and the stapes was seen at the upper part of the perforation. A hearing test revealed a pronounced right middle ear deafness. The Wassermann test was negative, as well as the fistula test. Examination of the eye grounds was also

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negative. A Roentgenogram of the mastoid regions showed bilateral chronic mastoiditis. The films revealed the mastoid cavities to be small and to contain very few cells. A tentative diagnosis of bilateral chronic mastoiditis with an acute exacerbation of the right mastoid region was made.

A right radical mastoidectomy was performed on June 11, 1936. The mastoid cortex was found to be hard and eburnated. The mastoid cavity was sclerotic; cholesteatoma and granulations were present. No fistulous areas were found.

Fig. 1. Patient following operation for the removal of a bony sequestrum.

The dura was exposed over an area of approximately 1 by $\frac{3}{4}$ cm., and found to be normal. It was thought that a brain abscess might be the possible cause of the symptoms. The middle ear cavity contained a partly necrotic malleus and an intact incus, which were removed. The operation was completed, with all the diseased cells having been removed. The patient tolerated the procedure well, although the postoperative convalescence was somewhat stormy. While her temperature ranged between 38° C. and 39° C., she was quite uncomfortable with pain and slight attacks of nausea and vomiting. The drains and skin clips were removed on the fifth postoperative day, and the wound healed satisfactorily.

For three months (July to September, 1936) the patient returned to the Otolaryngological Clinic for follow-up care and treatment. Excessive granulation tissue formed and was cauterized frequently with a silver nitrate stick. When the patient was discharged in September, a small swollen lymph node 4.5 cm. below the tip of the right mastoid was noted; it was the seat of a dull pain. This mass later increased in size. In addition, stabbing pain radiated to the back of her neck and right temple. Roentgenograms of the mastoids, taken again in October, 1936, showed the previously described sclerosis throughout both mastoid areas, with a defect in the tip of the right mastoid process, which was believed to be postoperative. The sclerosis of the right petrous tip was considerably more marked than the left. There was no evidence of any petrous destruction.

The patient was readmitted (December, 1936) for a local tonsillectomy, since it was thought that the mass on the right side of the neck might be secondary to a slight tonsillitis. Physical examination at this time revealed a firm, markedly tender mass, 1 by 2.5 cm. in size, about 5 cm. below the tip of the right mastoid process, along the anterior border of the sternocleidomastoid muscle. Following the tonsillectomy the patient still continued to have pain in the region of this mass. Daily for five weeks she was given short-wave diathermy treatments without relief. The mass was aspirated on February, 1937, but no pus was obtained. The body temperature was elevated a half degree Centigrade; the mass still remained firm without fluctuation. Hot local applications were continued, as advised, but the mass did not change in character. There had been no signs of inflammation about or within the right ear following the radical mastoidectomy. The possibility of some malignant lymphadenopathy was considered.

On March 9, 1937 (nine months after the right radical mastoidectomy), an incision and drainage of this region was done. A small fragment of bone, the size of a kernel of wheat, was removed. A bacteriological culture of the abscess showed staphylococcus aureus. Following the opening and drainage of the abscess, all symptoms disappeared. Within two weeks the neck wound was entirely healed, and all the tenderness had vanished from this region.

COMMENTS.

This abscess might have resulted from an extension of a bone chip with the retraction of a muscle fibre of the sterno-cleidomastoid muscle. Another possibility, however, is that this bony sequestrum might have been forced through the tip of the right mastoid process with a small curette. The defect in the tip of the right mastoid region which showed in the Roentgenogram following the radical mastoidectomy will be recalled. It is very important, therefore, that before the mastoidectomy is finished, the wound be carefully inspected, that all mastoid chips, no matter how small, be removed from the operative site.

University Hospitals.

CARCINOMA OF THE LARYNX. MODIFIED HEMILARYNGECTOMY. CASE REPORT.*

DR. JULIUS I. KLEPPER, New York.

S. K., male patient, age 60 years, came to my office on Nov. 4, 1936, with the following history:

He caught cold during June, 1936, and gradually became hoarse, his hoarseness getting worse and worse all the time. He was treated for the cold by his family physician and others.

The patient, on presenting himself at my office, complained of a frequent cough, choking sensation in the throat, hoarseness reduced to whisper, pain in the chest, fainting spells due to the anginoid attacks, giving a history also that his B. P. varied between 200-220 for years, but under medication his pressure came down as low as 175. On account of the heart and blood pressure, he was put under disability by his insurance company for the last three years. He also had diabetes for the same amount of time, sugar varying from 3 to 4 per cent. The patient's appearance was very much below par. He could hardly stand on his feet; and on account of his condition, we were not able to carry out the first and second examinations. This probably was due to his heart condition and associated anxiety. But on the third examination we were able to examine the larynx and the same revealed the following: a rounded mass, fairly large, the size of a bean, in the middle of the left vocal cord, and quite circumscribed. We ventured the diagnosis of malignant tumor based on the following facts:

The history, the age of the patient, the pain, the hoarseness, the location of the tumor, the rapid growth, and its grayish appearance. The patient was not told of the diagnosis, but his wife was informed. We advised immediate operation; that of laryngofissure, and the removal of the cord. The situation was clearly discussed with his wife, and she was told that if no operation was done at that time, a much more severe operation would have to be done soon afterward.

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*Read at the Clinical Society, New York Polyclinic Medical School and Hospital, Jan. 3, 1938.

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The patient left the office and returned subsequently on Dec. 22, 1936, six weeks later, and five months after the beginning of the hoarseness.

In the interval of his leaving my office, and his return, he was treated expectantly at another well-known specialized hospital for six weeks, because they could not make up their minds that this man had a malignancy; but before he left the hospital, a biopsy was taken, which proved to be a squamous-cell epithelioma of the left vocal cord.

He was admitted into the New York Polyclinic Hospital on Dec. 27, 1936. On admission, besides the above mentioned history, he showed a blood pressure of 185 to 190 and a large growth, the size of a fist, of a lipomatous character, on his back. This had nothing to do with the laryngeal condition. The patient also had a blowing systolic murmur, pulse rate accelerated.

Diagnosis on Admission: Carcinoma of left vocal cord of larynx, hypertension, cardiac insufficiency, and diabetes. The patient was a very bad risk for any operation. Dr. Hurd saw the case with me after admission, and we decided to do a hemilaryngectomy, modified in accord with our findings at the time of the operation. For two days previous to the operation the patient was rendered sugar-free.

Operation, Dec. 29, 1936: The operation began at 4 p.m., and ended at 5:45 p.m. Local anesthesia was used.

Procedure: The superior and inferior recurrent laryngeal nerves were injected with novocaine 1 per cent. The surface area over the middle line was also injected. An incision was made from the hyoid bone down to the sternal notch. The trachea was exposed; the isthmus of the thyroid gland was located, separated, sewed up tightly on both sides, ligated, and cut in between. A tracheotomy was done on the third and fourth ring, with partial excision of the tracheal edges; a tracheotomy tube was inserted and packing was applied around the tracheal tube. All layers over the thyroid cartilage were separated in the middle line. The perichondrium was separated on the left side. The cartilage was incised with an osteotome, the trachea was packed from above with gauze, the inner portion of the left side of the thyroid was separated and removed, together with the perichondrium and

the tumor mass. The tumor extended as far down as the cricoid and above as far as the arytenoepiglottic folds. On removing the soft tissues and perichondrium, the malignancy seemed to be extending and involving the left arytenoid; therefore, it was also removed. By leaving a framework of the upper portion of the thyroid cartilage, we were able to

Fig. 1. Carcinoma of Larynx.

keep the left side of the larynx in a form so that total collapse of the left side was prevented. The arytenoepiglottic folds of the left side were then brought down by suture to the tissue around the cricoid cartilage, and also to the arytenoid of the other side. So that the seat of the malignancy and the adjacent areas of cartilage were completely removed. During all this time cocaine 4 per cent was used for local anesthesia inside the larynx, and adrenalin and suction to con-

trol the bleeding. All tissues were sewed together in layers: perichondrium, fascia, and muscle. For all these chromicized catgut was used, and a dermic of silk suture was used for the skin, with outside dressing accordingly. We then removed the packing around the tracheotomy tube, the surrounding area was sutured, and the tracheotomy tube was left in place.

The patient returned to bed showing practically no reaction from the operation. He did not experience any pain during the whole operation; in fact, he seemed to be in a better condition than before the operation was begun. This was probably due to a psychological condition. Duration of operation, all included, was about one and three-quarter hours. The specimen was sent to the laboratory.

The histological report was as follows: The specimen consisted of a portion of tough rubber-like tissue said to have been taken from the vocal cords, rather flat, and measured $3\frac{1}{2}$x$2\frac{1}{2}$ xclm. On one side there was a portion of bony tissue. Microscopical examination showed a portion of tissue from the larynx in the region of the vocal cord. (There is a history of a previous pathological examination of a biopsy taken at The Memorial Hospital, under the number H6745, dated Dec. 15, 1936, with a report by Dr. Martin and Dr. Stewart.) The report was that of a squamous-cell epithelioma about grade 1+. There was also a well marked inflammatory lesion beneath the mucous membrane in some areas. This was particularly noticeable in the region of the epithelioma. The prognosis, after recovery from the operation, should be fairly good. Diagnosis: Squamous-cell epithelioma.

Postoperative Notes: On the day following the operation the sugar went up 0.5 per cent; two days after the operation, the sugar went up to 2.3 per cent; at this time he was given insulin and the sugar came down to 1 per cent. From then on his sugar varied between 1.2 to 3.7 per cent. On the fourth day he was put on a more rigorous diet and given from 10-20 units of insulin three times daily; urine also examined three or four times a day. The diet varied accordingly. Bevahior of the patient the first few days was none too good. His temperature rose, the mucopurulent secretion from the trachea and bronchi became very annoying, needing constant attention and suction. After proving by means of methylene blue that the patient could not swallow even liquids without the

same entering the trachea and bronchi, it was necessary to insert a duodenal tube. This having been done, all feeding from that time on was given through the tube. Orders were left that at no time should any secretion of large amount accumulate in the bronchi and trachea. Rigorous asepsis was observed, keeping the tubes as sterile as possible, at times inserting the tube down to the bifurcation of the trachea, leaving no accumulation of mucous or pus. By means of suction we were able to keep even the small bronchi free of pus. Oxygen was given from 10-15 minutes, every two hours, immediately following the suction. The patient was kept in a semirecumbent position and at a minimum of exertion. The outside dressing was changed twice daily. The alkalization of the patient was also essential to the treatment, keeping the patient acetone free. In the first week he showed some bronchial involvement, running a temperature between 100° and 103°, and after the first week his temperature came rapidly down to 100°. On the ninth day after the operation, all sutures were removed.

In the care of this patient I had the assistance of the medical service of Dr. Kutcher and the close vigilance of the internes; they took great pride in the follow-up of this patient. While the patient was quite co-operative, it cannot be said that he had a very smooth run. At times he was terribly exhausted, probably due to his heart condition; many times he was very miserable, so that stimulation had to be resorted to, and codeine given for his very annoying cough so as to give him rest, and occasionally luminol for sleep. He required careful watching by his nurses, who also were very anxious to do whatever they could for him.

The feeding tube was removed on the eighteenth day only after we had experimented with a liquid colored with cochineal, and suction applied in order to see if any of the liquid went down his trachea. When the result was negative, he was fed through the mouth. Examination of the larynx showed then a fairly large opening, and the patient was able to close his larynx in swallowing. The patient was out of bed on the sixteenth day. On the twenty-third day the tracheotomy tube was also removed only after repeatedly checking up his breathing with and without the tube, making sure that there was no obstruction to his normal breathing. The outside wound was kept scrupulously clean. He was

dressed twice daily and the trachea soon closed up completely. One month after the operation, the patient was walking and attending to his own necessities without assistance; he slept well, felt more comfortable, had no complaints, and left the hospital five weeks after operation:

In the subsequent care of the patient he was impressed with the necessity of rest for his heart and was advised to follow-up with his family physician the necessary medication. He was shown how to examine the urine for sugar and to control same with insulin.

The opening in the larynx assumed a form so that he was able to take care of all normal functions, his voice gradually improving, so that at present he has no difficulty in holding conversation.

The reasons we present this case are: That while these cases are very often fatal, especially with the complications this man had, we especially like to show that while this operation was delayed for almost two months, the operation we performed was the most suitable, not only for saving the patient from the advance of the malignancy, and therefore a life saving operation, but, in addition, we restored to the patient a normal breathing and living voice mechanism, in spite of the fact that teaching and practice of this method is generally disadvised. We advocate the principle, "let the form of operation suit the circumstances, the pathology, and the findings at the time of the operation, not an operation to a set form of procedure, which may not have sufficient bearing on the case." In other words, we preferred this operation in preference to a laryngofissure and subsequent radium treatment; we advise this operation in preference to doing a total laryngectomy. This method does not receive the full consideration that it should receive. We advise this operation as a modified laryngectomy, as described by us, and should be given more consideration by those interested in this special work.

The time to operate is early. The operation must meet the special conditions found at the time of operation. The operation as described by us, while not described in textbooks, may take its place as a modified hemilaryngectomy. We did not give this patient any subsequent radium or X-ray treatment, as we felt that the tumor and the adjacent areas were removed

enough to prevent a recurrence. In other words, we know that the larynx does not do well with X-ray or radium. The disadvantages of these treatments are that they devitalize normal tissue and diminish still more the slow healing power of the larynx. X-ray and radium should not be advocated except in a full bilateral extrinsic cancer of the larynx with or without glandular metastases when operative procedures are contraindicated and the case otherwise hopeless.

24 West 85th Street.

HEMORRHAGE FROM THE THROAT.

DR. LOUIS KLEINFELD, New York.

The following three cases, seen within a period of less than a year, show some instructive points:

Case 1: A child, age 4½ years, developed sore throat, cervical adenitis, temperature and vomiting. A few days later, a retropharyngeal abscess was opened. Two days later the child vomited several cups of bright blood and again the following day. Examination was essentially negative. Nevertheless, at this time ligation of the carotid was advised because of the recurrence of bleeding, but was refused. The next day the child died of a fulminating hemorrhage.

Case 2: An infant, age 16 months, had cervical adenitis for a week; bleeding was noticed from the nose and throat. A boggy mass was noted in the right lateral pharyngeal wall. The blood was seen coming from a rent in the posterior pharyngeal wall. Ligation of the carotid was again advised, but was postponed until transfusion was given, promptly following which a fatal hemorrhage occurred. Incomplete postmortem showed only a necrotic abscess of the retropharyngeal space.

Case 3: A child, age 2 years, had cervical adenitis for two weeks and dysphagia for two days. Examination revealed a mass pushing the right palate forward and extending down to the epiglottis. A mass, felt in the neck on the same side, was thought to be due to glands. A small nick was made over the mass in the pharynx and a blunt artery clamp inserted; no pus found. That night a fairly profuse hemorrhage was noted from the right ear, the significance of which was not realized by the interne, and which was consequently not reported to the attending surgeon. The next day a fulminating hemorrhage occurred from the ear and throat. Postmortem showed an abscess in the right parapharyngeal region with a ruptured aneurysm of the lingual branch of the carotid artery.

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The points of interest in the above cases were: *1.* The presence of recurrent hemorrhages (Case 1), or a single large hemorrhage (Case 2), or hemorrhage from the ear (in the presence of cervical infection) indicates the probability of a fulminating hemorrhage; *2.* transfusions are worse than useless and ligation of the carotid artery should be done promptly. The only other therapy is to tie a loose ligature around the carotid and have a doctor present day and night who can tie the ligature tight at the first sign of hemorrhage. The attendants on these cases should be instructed about the seriout significance of a hemorrhage from the ear in this type of patient.

BIBLIOGRAPHY.

SALINGER, S., and PEARLMAN, S. J.: Hemorrhages from Pharynx. *Arch. Otolaryngol.*, Oct., 1933.

17 East 84th Street.

THE RELATION OF CLINICAL CONDITIONS OF THE UPPER RESPIRATORY TRACT TO OXYGEN METABOLISM.*

DR. D. C. JARVIS, Barre, Vt.

Introduction: I might say by way of introduction that interest in oxygen metabolism was aroused by a study of silica dust inhalation.

It was discovered that a number of clinical conditions of the respiratory tract, such as bronchitis and pneumonia, could be duplicated with silica dust inhalation. The X-ray appearance of postinfluenzal conditions, pulmonary tuberculosis pneumonia and new growths can all be duplicated with silica dust inhalation.

With the passing of time a suspicion was aroused that the central problem in medicine was not the problem of infection, but the problem of oxygen metabolism. So for a number of years the problem of oxygen metabolism has been studied as a clinical research problem, and at this time I wish to present the results of this study for your consideration.

APPROACH USED IN STUDYING OXYGEN METABOLISM.

In studying the relation of oxygen metabolism to clinical conditions of the upper respiratory tract, the method of the industrial chemist in approaching an industrial problem has been followed.

The industrial chemist informs himself by a study of energy relationships that the reaction he is interested in is physically possible. Then in most instances he begins a search for a catalyst, or activator, which will alter the velocity of the reaction without itself appearing in the end product. Industrial production can begin when he has made his process rapid and efficient.

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In applying this approach to a study of the relation of oxygen metabolism to clinical conditions of the upper respiratory tract, the first step required a study of the chemical composition of the body and the part oxygen metabolism plays in the building and rebuilding of the body cells. The second step required a search for catalysts, or activators, that would speed up oxygen metabolism. The third step required the presentation of oxidizing catalysts to the body during sickness in order to learn whether a return to normal health was more rapid and efficient when they were used.

CHEMICAL COMPOSITION OF THE BODY.

Turning then to a consideration of the chemical composition of the body, it is only natural that we should turn to a consideration of its elementary composition in order that we may learn what this chemical composition may be. As we do so, we find the elementary composition of the body to be represented by the following:

ELEMENTARY COMPOSITION OF THE HUMAN BODY.

Element	Approximate Per Cent in Body
Oxygen	65.00
Carbon	18.00
Hydrogen	10.00
Nitrogen	3.00
Calcium	1.50
Phosphorus	1.00
Potassium	0.35
Sulphur	0.25
Sodium	0.15
Chlorine	0.15
Magnesium	0.05
Iron	0.004
Iodine	0.00004
Fluorine	Trace
Silicon	Trace

As this list is studied more at length, one notes the large percentage of oxygen present. Because of the presence of such a large amount, its function in the body must be most important.

Here then apparently lies the chemical composition of the human body. But if one is to build and rebuild the human body in accordance with its chemical composition, the question arises as to the source of the minerals that will enable

us to carry on this building and rebuilding process. Let us turn, for a few moments, to a consideration of the analysis of the earth's crust and atmosphere.

ELEMENTS IN THE EARTH'S CRUST AND ATMOSPHERE.

Element	Approximate Per Cent
Oxygen	50.02
Carbon	0.18
Hydrogen	0.95
Nitrogen	0.03
Calcium	3.22
Phosphorus	0.11
Potassium	2.20
Sulphur	0.11
Sodium	2.36
Chlorine	0.20
Magnesium	2.08
Iron	4.18
Iodine	?
Fluorine	0.10
Silicon	25.80

Again we find the same 15 elements present, with a large percentage of oxygen. Here then apparently lies the source of the minerals to be used in maintaining the chemical composition of the body. But the question arises as to how these minerals are to be transferred to the human body, because man is not so constituted that it is possible for him to eat dirt.

Let us turn to a comparison of the elementary composition of the human body and the analysis of the earth's crust and atmosphere, and note whether a similarity exists. As we study the two tables and make a comparison, we note that a similarity does exist, which makes it seem reasonable to conclude that man was intended to maintain the chemical composition of his body by eating products of the soil, such as fruits, vegetables and nuts, which have transferred the soil minerals to their own composition.

So much then for the chemical composition of the human body. Now let us turn for a few moments to a consideration of the part oxygen metabolism plays in the life of the cell.

THE BUILDING AND REBUILDING OF THE CELL.

A study of the cell, or cytology, as it is sometimes called, may rightly claim to be the frontier state in the body chem-

istry commonwealth. Within the borders of this state we find a common meeting ground, for in the last analysis the cell must sooner or later claim our attention as representing the unit of which this body of ours is built. We build and rebuild the cell by means of the food we eat, the liquid we drink and the air we breathe. If this is not true, then the question arises as to what do we build and rebuild the cells of our body with?

In pursuing the subject of oxygen metabolism we eventually come to a point where we realize that disease can be traced as far down as the minutest portion of the body, which is the cell. Here we find that every cell will be in a fit condition to do its job satisfactorily just as long as the environment in which it must live is congenial. This, according to biology, means as long as it is supplied with the proper quantity and quality of food material and oxygen, and as long as its waste products are promptly removed.

Every cell in the body must live in a liquid medium. Every cell is surrounded by fluid. Every cell selects from out of this fluid which surrounds it the food and oxygen it needs to support cell life. And every cell excretes back into the surrounding medium all of the waste produced by its vital activity. The fluid between these cells must be kept constantly flowing. If it should stop, the cells might languish and perhaps die, not only from lack of nutrition and oxygen, but also because they will be surrounded by their own poisonous waste materials. We might say then that disease begins when some of the factors constituting this fundamental law of life are interfered with. A cell may not get the proper quantity or quality of food and oxygen. Or the cell may not have its waste materials removed promptly enough. Possibly a departure from normal body chemistry begins when some one of the factors constituting the fundamental life of the cell are interfered with.

Is it possible that the symptoms and manifestations of disease are due to the cells' rebellion against an uncongenial environment? Is it possible that in the beginning these reactions take the form of what we call acute diseases; that is, diseases which are attended by a rapid elevation of temperature, an increase in the pulse and respiratory rates, and are we to understand that a clinical condition often becomes

chronic after the cells have become tired and have lost their power of violent reaction to an uncongenial environment?

The single cell then is a convenient unit of functional activity. We cannot progress in an understanding of the chemistry of the body unless we have as good a knowledge as possible of the intercellular processes. When the body as a whole establishes an equilibrium with its environment, it does so by the machinery of its individual cells. From a study of the cell we make progress in building up a concept of what the body as a whole is like in its body chemistry.

The source from which animal heat is derived is not, as a rule, difficult to locate. It is nearly always the result of oxidation of an intracellular compound. The oxygen is derived from the fluid which surrounds the cell and the product of oxidation, which is carbon dioxide and water, is liberated into this same fluid surrounding the cell.

The machinery whereby the living cell is able to carry on the process of respiration and oxidize its respirable materials is bound up in the so-called oxidizing enzymes. In the presence of these enzymes the oxidizable substances in the cell and the free oxygen of the environment cease to represent a stable inactive system and become an active system in which the oxidizable substances are rapidly converted into carbon dioxide, water and other products.

In a general sense, each chemical reduction within the cell may be considered a synthesis; *i.e.*, the formation of a new compound. The importance of cell synthesis is primary, since in no other way can each type of living organism acquire the constituents and structure which characterize it than to make them from available raw materials. Plants, for example, are able to reduce atmospheric carbon dioxide and nitrogen with free energy supplied by the sun and thereby to synthesize the constituent substances. Animals cannot utilize the free energy of sunlight directly, but must depend upon the oxidative destruction of plant substances for the release of stored solar energy. Thus, the oxidation of plant substances gives animals the free energy for their own synthesis, which are necessary for growth and repair. This process is known as coupled oxidation.

OXIDIZING CATALYSTS.

The next step in our approach to the general problem of oxygen metabolism brings us to a consideration of oxidizing catalysts. The importance of catalysts is well appreciated by the organic chemist, who has found that reactions involving compounds of carbon seldom take place without the intermediation of a strong agent.

The "unreactiveness" of organic substances he attributes to a characteristic immobility of electrons which causes a powerful bonding, not only between carbon atoms themselves, but also between carbon atoms and various other constituents of the organic molecule. Consequently organic substances are very stable; *i.e.*, they do not spontaneously undergo the theoretically possible oxidation.

From time to time one hears the term heart block used, which makes it seem reasonable to use the term oxygen metabolism block as signifying a block in the carbohydrate oxidation chain. This term implies than an interference exists in the changing of hexose into carbon dioxide and water. Clinical experience leads one to feel that it is possible to overcome this oxygen metabolism block by prescribing the proper oxidizing catalyst, or activator. Trial and error has shown the following catalysts, or activators, to be efficient in overcoming the oxygen metabolism block. These are thyroid extract, dilute hydrochloric acid, iodine and three unit doses of insulin.

THYROID EXTRACT AS AN OXIDIZING CATALYST.

The best known effect of thyroid secretion is the acceleration of metabolism. This is concerned with the oxidative processes of all body tissues. In animals which have been thyroidectomized, oxidation and heat production are depressed to 60 per cent of their normal level, and if thyroid is fed to a normal animal, oxidation and heat production are increased.

Cameron says there seems to be little doubt as to the general truth of Plummer's view that the thyroid principle exerts an influence on the oxidation processes in all the cells of the body and thus produces its physiological effects.

In prescribing thyroid extract as a catalyst, one starts with 1/10 grain a day with the expectation, if necessary, of build-

ing up to one grain a day. After a patient gets his empty reservoirs a bit filled up at the 1/10 grain a day dosage, his tolerance usually increases and the dosage can be gradually raised to one grain. In a certain proportion of cases 1/10 grain a day seems adequate for maintenance. If nothing happens in two weeks when the 1/10 grain daily dose is prescribed, then one can gradually build the dose up to one grain a day. If results do not appear at this dosage, then thyroid extract as a catalyst is dropped. Sometimes one has to wait several weeks for any benefit to show up, but if he has patience I think he seldom fails to obtain good results if the oxidation level happens to be low.

The favorable results that turn up with gratifying frequency are a general sense of well-being, improved general nutrition, especially that of the hair and skin, correction of constipation when present, and in older patients an apparent turning back of the metabolic calendar, sometimes as much as ten years. It often takes ten years from the age of the circulatory system.

DILUTE HYDROCHLORIC ACID IN FIVE TO TEN DROP DOSES AS AN OXIDIZING CATALYST.

Some time ago, one of my human guinea pigs, a teller in a bank, came to the office to relate his experience with dilute hydrochloric acid taken on an empty stomach. He stated that the previous Sunday, while spending the afternoon at the home of his parents, he experienced some distress in his stomach. He started to prepare some sodium bicarbonate in water to relieve his distress, but his mother suggested he take dilute hydrochloric acid instead, as I had prescribed it for her to relieve gastric distress following eating. He added five drops to a glass of water and drank it. One hour later he experienced more stimulation than would result from taking three cocktails, he said. He is a chap who drinks socially. Feeling, as a result of the stimulation, that the medicine must be powerful, he wished to learn whether he could continue to take it and in what dosage to relieve gastric distress and produce stimulation. I smiled at his statement and endeavored to assure him that five drops was a very modest dose and he need have no fear of ill results if it was repeated a number of times during the day.

As I have learned many useful things from taking statements of my patients and human guinea pigs seriously, I decided to try out the five drop dose of dilute hydrochloric acid on myself the following day, taking it on an empty stomach. Five drops in a glass of water were taken at 1:30 p.m., 2:30 p.m., and 3:30 p.m. By 5 p.m., I was walking around on air. I felt as if I had had 20 cups of coffee. I was never so keyed up in my life. I didn't expect to sleep a bit that night, but, contrary to my expectation, I went to sleep at once, slept soundly all night and awoke in the morning feeling as if I had had a two weeks' vacation. It dawned on me that I was dealing with a catalyst and dilute hydrochloric acid taken on an empty stomach touched off some trigger mechanism in the gastrointestinal tract which resulted in stimulation of the sympathetic division of the autonomic nervous system.

I then requested the adult "guinea pigs" to try out dilute hydrochloric acid in five drop doses in a glass of water on an empty stomach.

The unanimous report was that with the help of five to ten drop doses of dilute hydrochloric acid taken on an empty stomach it was possible to control fatigue and banish it at will. I then experimented on myself and found this to be true. Five to ten drops of dilute hydrochloric acid in a glass of water on rising, the middle of the forenoon, the middle of the afternoon and at bedtime enabled me to remain free from fatigue, so that I ended the day's work feeling as good as when I started in the morning. Since then I have prescribed five to ten drop doses of dilute hydrochloric acid, in a glass of water, on rising, middle of the morning, middle of the afternoon and at bedtime, or sometimes only on rising and at bedtime. Patients report, as a rule, that they are very much less tired at the end of the day when the acid is taken. I ask the patient to experiment a bit and find out whether five, ten or 15 drops of the dilute hydrochloric acid represents the most effective dose for him. Then I ask him to experiment with the intervals between doses and find out whether a morning dose is all that is required, or a morning and evening dose, or a dose of the acid on rising, middle of the morning, middle of the afternoon and at bedtime represents the required daily amount. If a patient is going out

socially, in the evening, three five or ten drop doses of dilute hydrochloric acid in a glass of water taken in the afternoon on an empty stomach, one hour apart, will generally banish fatigue, so that one may keep the evening social engagement, spending the evening without a feeling of fatigue being present. The relief from the sense of fatigue comes in one to one and one-half hours after the dilute hydrochloric acid is taken. In my own case, one and one-half hours is required before I shake off the feeling of fatigue.

As a relation of fatigue to dilute hydrochloric acid in 5 to 10 drop doses taken on an empty stomach was studied, it was observed that it influenced secretion of mucous membrane and relieved pain. Draining paranasal sinuses showed a lessening of drainage, and in other patients the nose and postnasal space became free from discharge. Patients who were given dilute hydrochloric acid on an empty stomach in order to influence clinical conditions of the upper respiratory tract reported that the pain associated with neuritis and arthritis disappeared or was much lessened. When the upper respiratory tract clinical condition had been relieved, they were directed to discontinue the doses of dilute hydrochloric acid. In from two to four days after discontinuing the dilute hydrochloric acid, occasionally one would get in touch with me, requesting that he be allowed to continue the acid, as his pain had returned.

From previous observations I learned that a relation existed between postnasal dripping, paranasal discharge, dried secretion within the nose and the individual's carbohydrate intake. The greater the intake of starchy foods and cereals, the greater the amount of the discharge. The less starchy foods and cereals taken, the less discharge was present. With dilute hydrochloric acid taken on an empty stomach the discharge in the upper respiratory tract decreased or disappeared without decreasing the carbohydrate intake. These observations led me to conclude that dilute hydrochloric acid taken in small doses on an empty stomach was an oxidizing catalyst because the character of the secretion of mucous membrane within the nose could be made to change by either varying the intake of food material, such as starchy foods and cereals, requiring oxidation within the body or prescribing dilute hydrochloric acid in 5 to 10 drop doses to be taken on an empty stomach

on rising, the middle of the morning, the middle of the afternoon and at bedtime in order that it might act as an oxidizing catalyst.

The results that come with gratifying frequency from small doses of dilute hydrochloric acid taken on an empty stomach are a return to normal of the secretion of mucous membrane, relief from pain and control of fatigue. In addition, an improved nutrition of the skin results in a pink color coming to the skin even though the hemoglobin may continue to read in the seventies. The hair grows more rapidly and becomes oily. It turn back the metabolic years, bringing new vigor and endurance to the body.

Dilute hydrochloric acid may be taken in water, orange juice, lemonade, grape fruit juice or ginger ale.

IODINE AS AN OXIDIZING AGENT.

Iodine, iron, copper and manganese represent the four best oxidizing minerals. They are found in various foods which we are very apt to eat only occasionally.

Iodine occupies a unique position among the mineral requirements of the body. Iodine and the iodides have been extensively used in the treatment of various clinical conditions, and though its beneficial effects have been noted, there has always been a difficulty in explaining its mode of action, for it is rapidly excreted in the urine.

Small, even minute, doses are equally efficacious. It acts in the same way, whether absorbed from the alimentary canal or from the respiratory tract, its action in minute doses being that of a catalyst or activator.

In prescribing iodine as a catalyst, Amend's solution has been used. In iodine content it is one-seventh as strong as Lugol's solution, and may be taken indefinitely without upsetting the stomach. Three drops once a day, 20 minutes before the midday meal, is the initial dose, with the expectation, if necessary of building up to three drops 20 minutes before each meal of the day. In the 12 children under six years of age who served as human guinea pigs, it is possible to repeatedly change an irritable, impatient and restless child into a calm, patient individual within two hours' time by giving one drop of iodine solution by mouth in a vegetable or fruit juice.

The following results may be expected from the use of iodine as an activator: Sense of well-being and comfort, with accompanying improvement in temperament and outlook on life, a sense of warmth and an increase in circulation, with ambition to carry on work. Patients will frequently state that the bowel action is freer, reducing the need of drastic cathartics. There is also an increase in the quantity of urine, at least temporarily, and the appetite is improved. The capacity of the mind to carry on its activity is noticeable. A patient subject to cold extremities and cold or clammy skin will notice improvement within as short a time as 24 hours after the administration of small doses of iodine. There is a decrease in blood pressure, increase in the activity of the skin circulation and improved color. The turbinates, lymphoid nodules on the posterior pharyngeal wall and tonsils decrease in size when iodine is prescribed in catalytic doses.

Iodine may be taken in orange juice, tomato juice, ginger ale or milk.

CATALYTIC EFFECT OF THREE UNIT DOSES OF INSULIN.

The dose of insulin must be small so that no adrenin will be discharged from the suprarenal glands. The intervals between doses must be of such length that clinical progress is maintained. Large doses of insulin may produce an edema while small doses relieve an edema. If when giving small doses of insulin over a period of months, a slight edema of the tissues appears, it is an indication to either lengthen the interval between doses or reduce the size of the dose.

As to the size of the dose in this new found use of insulin, 5 units represent a maximum dose, 1 unit a minimum dose, with 3 units the average dose. Five unit doses are rarely ever used. Three units represents the usual dose. At to the method of giving it, it is given subcutaneously each day if the clinical need is great. As clinical improvement takes place the intervals between doses are lengthened to every other day and later to Tuesday and Friday, or a similar interval.

THE THEORY OF OXYGEN METABOLISM.

1. The theory of oxygen metabolism assumes that the central problem in medicine is not one of infection, but one of oxygen metabolism.

2. Sixty-five per cent of the elementary composition of the human body is represented by oxygen, which indicates its importance. The remainder of the elementary composition of the human body is represented by minerals.

3. Oxidizing catalysts, such as iodine, iron, copper and manganese, required by the body are taken in as minerals found chiefly in fruits and vegetables.

4. A lack or insufficient intake of oxidizing catalysts results in a block in the carbohydrate oxidizing chain.

5. The body, in order to overcome this block in oxygen metabolism, breaks down body tissues to obtain the desired minerals which are normally present in its composition.

6. This breaking down of body tissues to secure the necessary minerals with which to carry on oxygen metabolism is made known clinically by the appearance of albumin, sugar, pus, one or all three, in the urine, a change in the normal secretion of mucous membrane, the appearance of a purulent discharge in various parts of the body and loss in continuity of tissue, as seen in ulceration.

7. The presentation of oxidizing catalysts to the body as represented by small doses of thyroid, dilute hydrochloric acid, iodine, small doses of insulin, fruit, vegetables and nuts for the oxidizing minerals they contain generally results in disappearance of albumin and sugar from the urine, a return to normal of the secretion of mucous membrane, the disappearance of a purulent discharge when present in various parts of the body, and the restoration of a break in tissue continuity.

CLINICAL APPLICATION OF THE THEORY OF OXYGEN METABOLISM. THE COMMON COLD.—ITS PREVENTION.

In dealing with the common cold one needs to appreciate the fact that there are 10 different varieties and that some of these are due to environmental conditions directly controllable by the patient. Other than these, the common cold may generally be prevented during the winter months by the use of oxidizing catalysts, the including in the food intake foods representing a good source of iodine, iron, copper and manganese, the four best oxidizing materials, and a relatively low intake of carbohydrate foods, such as starchy foods and cereals, which require oxidation in the body.

For prevention of common cold, three unit doses of insulin represent the best oxidizing catalyst, 5 to 10 drop doses of dilute hydrochloric acid the next, and 1 drop daily of iodine the next.

The three units of insulin are given subcutaneously every 10 to 15 days, depending upon how susceptible the individual is to colds.

The dilute hydrochloric acid in 5 to 10 drop doses is taken in a glass of water or other liquid on an empty stomach, the amount of the daily intake being controlled by the reaction of the urine taken on rising and at bedtime with Squibbs nitrazine paper. The patient is instructed to maintain a weakly acid urine.

As for the iodine, 3 drops of Amend's solution in a suitable liquid vehicle is taken once a day 20 minutes before the midday or evening meal.

In preventing the common cold, three unit doses of insulin work best when the patient is over 50. Dilute hydrochloric acid is best when the patient is between 20 and 50, while iodine is the oxidizing catalyst of choice in preventing colds in children.

RELIEF OF SYMPTOMS.

When a patient presents himself with a common cold, he comes to the office once a day for three days. Each day he is given three units of insulin subcutaneously. As beef and pork insulin are both on the market, he is asked if he is sensitive to either beef or pork. If sensitive to one, he is given the other type of insulin. Immediately following the giving of the insulin, he is given by mouth 3 drops of Amend's solution of iodine in a glass containing equal parts of water and grape juice. If no other kind of iodine is at hand, 3 drops of tincture of iodine may be used.

As a rule, if the case is seen in the early stages, the first treatment will bring about 50 per cent improvement. The second treatment will generally complete the relief from the symptoms, but a third treatment is given to make sure of the results desired. By using oxidizing catalysts, or activators, a low carbohydrate food intake to lessen the oxidation load, the common cold, in the majority of cases, may be limited to 24 or 48 hours' duration. The longer the duration

of the cold, the less successful is the treatment in cutting it short.

SIZE OF TURBINATES.

With the passing of time it was observed as dilute hydrochloric acid was prescribed to be taken on an empty stomach on rising, middle of the morning, middle of the afternoon and at bedtime, that patients very often developed two new symptoms. One of these was a stuffy nose and the other was a sore throat. Occasionally, these two symptoms appeared in two weeks' time. More often they appeared after dilute hydrochloric acid had been taken daily on an empty stomach from one month to six weeks.

Examination of the nose showed increased size of the turbinates. Examination of the throat showed the presence of lymphoid nodules on the posterior pharyngeal wall and lateral bands of lymphoid tissue just posterior to each posterior tonsil piller. These the office record showed were not present at the time of the first visit.

Apparently this lymphoid tissue appearing in the pharyngeal region was the cause of the sensation of soreness on swallowing, for when it disappeared the soreness in the pharyngeal region also disappeared. In time I learned to advise patients to discontinue the dilute hydrochloric acid when stuffiiness of the nose and soreness of the throat appeared.

When iodine was prescribed in 1 to 3 drop doses by mouth 20 minuets before each meal, patients often volunteered the information that at the end of two weeks to a month's time their nose was very much more open, there being an improved nasal airway. Examination of the nose showed a decrease in size of the turbinates and, according to the patient's record, a lessening in size of lymphoid nodules on the posterior pharyngeal wall, these nodules finally disappearing.

Apparently, then, in dilute hydrochloric acid and Amend's solution of iodine, we have two therapeutic agents that will influence the size of turbinates and lymphoid tissue in the throat. The dilute hydrochloric acid in a certain proportion of cases will bring about an increase in size of the turbinates and pharyngeal lymphoid tissue, while iodine will bring about a decrease in their size. Possibly there may be a change in

blood chemistry, brought about by those two therapeutic agents. Working alone, as I do, I am not in a position to answer the question. I suspect the dilute hydrochloric acid increased the phosphorus content of the blood.

PARANASAL SINUSITIS.

Observing that dilute hydrochloric acid in 10 drop doses taken in a glass of water on rising, middle of the forenoon, middle of the afternoon and at bedtime controlled an attack of influenza so that it was not necessary for the patient to go to bed, and there was a return of the usual strength and vigor on the fourth day, and also observing that the discharge from a chronic sinusitis cleared up under the dilute hydrochloric acid by mouth, a reduction of the carbohydrate intake and prescribing two spinach tablets at the midday and evening meals for the four oxidizing minerals they contained. I awaited the appearance of a patient with an acute antrum, with the classical symptoms which had developed on an influenza background. In time, such a case appeared, it being my good fortune for the purpose of clinical research to have as such a patient a minister who always carries a heavy public speaking schedule in addition to his pastoral duties.

He was seen at five o'clock on Tuesday afternoon for the first time. He stated he had been trying to fight off an attack of influenza for the past three days, being able to keep his speaking duties in spite of the headache and body pains, but 24 hours previous he had developed a severe pain in the right side of his face, with tenderness present on external palpation and soreness of his teeth on the right side of the upper jaw.

He had been unable to sleep the night before and had not been free from pain in his face during the day. In addition, a profuse discharge was coming from the right side of his nose. He asked me to relieve his illness so that he might keep his speaking dates, as among other engagements he had accepted an invitation to speak at a large union church service the following Sunday night in a city 115 miles from Barre.

Examination showed a temperature of 101° F., a right antrum dark on transillumination and discharging pus into the nose. The clinical indications called for relief from pain, cessation of discharge and return of usual body strength and

vigor in as short a time as possible. All three, I realized from past clinical experience, could be met with dilute hydrochloric acid, but I had never before met with all three in one case, with an influenza background.

In order that I might find out the value of dilute hydrochloric acid as an oxidizing catalyst, nothing was done to the nose except inspection. He was requested to take 10 drops of dilute hydrochloric acid in a glass of water at 6 p.m., 7 p.m., 8 p.m., 9 p.m., and 10 p.m. If, during the night he had pain, he was to continue the 10 drop doses of dilute hydrochloric acid each hour up to a total of 100 drops and to apply heat externally. The following morning he phoned that by 9 p.m., on the previous evening, the pain in his face had disappeared. He slept from 10 p.m. to 2 a.m. in naps, and from 2 a.m. to 8 a.m., he slept soundly. He awoke to find his headache and body pains gone. Only a feeling of discomfort was present.

The profuse discharge from the right side of his nose remained. Having a feeling of renewed strength, he wished to keep an afternoon speaking date he had in Barre and wished advice as to whether he should keep it. I suggested he take three 10 drop doses of dilute hydrochloric acid in a glass of water one hour apart during the morning and 10 drops one-half hour before he was due to fulfill his afternoon speaking engagement at 3 p.m. I asked him to report at the office after he was through. He reported that he used three handkerchiefs within one hour while keeping his engagement. His temperature was 99.4° F.

He was requested to take 10 drops of the dilute hydrochloric acid in a glass of water on rising, middle of the morning, middle of the afternoon and at bedtime each day. Six days from his first office visit his antrum was no longer draining, it being no longer necessary to use a handkerchief, nor was discharge present in his nose or nasopharynx on awakening in the moning. In a letter to me he writes: "Although a heavy schedule of extra speaking and work continues, I am more active and free from tiredness than before the sickness came."

LARYNGITIS.

Knowing that thyroid tablets were of value in treating fatigue laryngitis and stumbling onto the clinical observation

that dilute hydrochloric acid restored the resonance in the voice of those speaking in public, I tried dilute hydrochloric acid in acute and subacute laryngitis, because I had learned that dilute hydrochloric acid and thyroid tablets were synergistic. Much to my surprise, the voice returned to normal in three days.

If a patient with acute laryngitis is seen on Saturday, 10 drops of dilute hydrochloric acid in a glass of water are prescribed on rising, middle of forenoon, middle of afternoon and at bedtime. On Sunday the speaking voice is generally 50 per cent of normal, and on Monday it will be practically normal. In a child, age 4 years, the dose given was 4 drops, with return of the voice to normal on following day.

At the present writing I am not sure what the dose of the acid should be, because I have observed the same clinical result in a married woman when 5 drops of the acid were prescribed on rising and at bedtime. This result leads one to suspect that the clinical results are brought about by a catalytic action of the dilute hyrochloric acid, it serving as an activator to the body processes that restore the tissues of the larynx to normal.

SUMMARY.

1. The central problem in medicine is not one of infection, but one of oxygen metabolism, the clinical evidence would have us conclude.

2. The theory of oxygen metabolism as a working hypothesis assist in explaining clinical results which follow the prescribing of oxidizing catalysts.

3. The oxygen metabolism catalysts best adapted to clinical use are 1/10 gr. doses of thyroid, three unit doses of insulin, 5 to 10 drops of dilute hydrochloric acid, and 1 to 3 drop doses of iodine.

4. Using the oxygen metabolism approach, clinical experience leads one to feel that it is possible to limit the duration of the common cold to 48 hours. An acute antrum on an influenza background may be limited to six days. The size of turbinates may be influenced, also the behavior of lymphoid tissue in the pharyngeal region.

Quarry Bank Building.

A SHORT REPORT ON THE USE OF A NEW LOCAL ANESTHETIC AGENT WHICH GIVES PROLONGED ANALGESIA.*†

DR. WALLACE MORRISON, New York.

The new anesthetic solution which I wish to bring to your attention is isoamylhydrocupreine, the trade name of which is eucupin.

The Chemistry of Eucupin: Eucupin is a synthetic alkaloid closely related to quinine, the basic alkaloid for both being cupreine. Quinine is methylycupreine; dihydrocupreine is made from it by hydrogenation, and eucupin results when an isoamylether is made from the hydroxyl group on the quinoline ring of this compound. The empirical formula is C_{24} H_{34} O_2 N_2. It forms addition salts with acids. It is usually employed for clinical use in the form of eucupin dihydrochloride. This is a fine white crystalline powder, with a very bitter taste, which is soluble in 15 parts of water and in alcohol. On the addition of alkalies to such a solution, the eucupin base precipitates; hence, alkaline solutions must not be mixed with the drug, or turbidity will result.

The Pharmacology of Eucupin: The action of eucupin on experimental animals is similar to that of quinine, in that fairly large doses of its salts stimulate the vagus and the respiratory centres in the medulla. Perfusion experiments on smooth muscle indicate that eucupin is mainly inhibitory and causes relaxation. The pressor effect of epinephrine is diminished by eucupin, so that when it is used as a local anesthetic, rather more epinephrine must be added to the solution than with some other anesthetics to minimize hemorrhage.

The direct application of eucupin in 1:1,000 solution paralyzes sensory nerve fibres. Absorption of eucupin after hypodermic or intramuscular injection is very slow, so that part of the solution remains in the area of injection for days.

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†From the Department of Rhinolaryngology of the New York Polyclinic Medical School and Hospital.

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Within 24 hours after intravenous injection of a nearly fatal dose in the experimental animal no eucupin can be demonstrated in the organs, and none has been excreted, indicating that the drug is destroyed in the body.

The Properties of Eucupin in Its Clinical Application: Morgenroth and his co-workers showed that eucupin destroyed many organisms, so that it has *bactericidal* powers. It is stated to be destructive to pneumococci in 1:20,000 dilution, to the hemolytic streptococcus in 1:40,000 dilution, to the staphylococcus albus in 1:16,000 dilution, and to the diphtheria bacillus in 1:2,000 dilution. This factor of bactericidal power is probably an advantage when injections of the drug are made about the mouth and pharyngeal cavities, as it will tend to prevent the development of local infection by bacteria carried into the tissue from the mucosal surface by the hypodermic needle.

The *local anesthetic* action of eucupin is very marked. The onset of anesthesia is delayed, however, because of the slow tissue diffusibility. For this reason, and because injections of plain eucupin cause some initial burning sensation, it is customary to employ eucupin in combination with procaine or other injectible anesthetic solution, and with ethylaminobenzoate for local application in ointment form. Solutions of eucupin of greater strength than 0.2 per cent should not be injected because of the possibility of local tissue reaction.

The Toxicity of Eucupin: The toxicity of eucupin is relatively low, being about twice that of quinine. The subcutaneous minimum lethal dose for mice is about 300 mg. per kilo of body weight, while the toxicity by intravenous administration is 30 to 70 mg. when the 1:1,000 solution is used. When employed as an infiltration anesthetic, toxic reactions are unlikely to occur. It would require several gallons of a 1:1,000 solution to approach the minimum lethal dose.

Idiosyncrasy is occasionally observed, as it is to quinine and many of its derivatives. Urticaria has been reported following the injection of eucupin. The author can report one case, in which the injection of less than 1 c.cm. of eucupin procaine subcutaneously was followed by a widespread erythema without pruritus within 24 hours, which faded in two days, and left no traces; there was local bleb-formation

about the site of injection, with a mild impetiginous secondary infection, which disappeared in a week.

The Uses and Results of Use of Eucupin: The particular use to which eucupin has been put in rhinolaryngology is of course to secure prolonged analgesia after local tonsillectomy. It is employed in the strength of 1:1,000 or 1:500, in procaine solution, 1 per cent. The injections about the tonsil are made in the usual manner. Immediate anesthesia is due to the action of the procaine, and no interference with its action has been observed. Epinephrine solution, 1:1,000, should be added in the proportion of eight minims to the ounce of eucupin procaine solution. If it is not used there will be a definite, though not serious, increase in bleeding, especially from small vessels.

The action of the eucupin begins slowly, but has the considerable advantage that it usually prevents the initial sharp pain experienced as the effect of the procaine wears away in the first hour after tonsillectomy, and that the effect of analgesia lasts for a considerable period.

Our early experience was with the 1:1,000 strength, employed without letting the patient know that a different solution was being used on the left side of the throat. A decided effect was almost universal. The patients almost invariably reported that the left side was less sore for the first 24 to 48 hours. It was then decided to use 1:500 solution. The effect was very much more pronounced, so that it became the rule that the patient had very slight postoperative pain and soreness; this effect lasted in most cases for a full 24 hours, occasionally for 48 hours, and sometimes until the height of the inflammatory reaction was reached during the third postoperative day. Effects after this period was reached have not been observed.

Upon the basis of more than 100 applications of eucupin procaine, we are able to state that no toxic effects have been observed, either upon injection or afterward. Unless epinephrine is used in the proportion of 8 drops of the 1:1,000 solution to the ounce of anesthetic solution, there is increased bleeding during the operation. This is usually from smaller vessels, and is readily controlled by sponge pressure, or crushing the vessel with the tonsil hemostat. Postoperative bleeding has not been increased by the use of eucupin. No local

infections of the paratonsillar tissues or neck have occurred. There is a tendency for increased submucous oozing of blood in the tonsil pillars, which often have a purple tint after 24 hours. This causes the throat to look rather worse than is usual, but the ecchymosis fades in three or four days.

The eucupin procaine mixture has also been employed by infiltration for the electrocoagulation of tonsils and tonsil remnants, as well as the pharyngeal lymph follicles and lateral pharyngeal lymphoid bands. Anesthesia is usually prompt and as satisfactory as with plain procaine. Bleeding during or after the electrocoagulation is not increased. A period of from 24 to 36 hours usually passes before there is soreness and pain on swallowing.

Eucupin with ethylaminobenzoate is made in ointment form, and has been tried in itching skin lesions such as the dermatitis seen about the nose and ears, infected impetigo of the nose and lips, acute sunburn and ordinary burns, with prompt relief of itching and soreness, and smooth healing without infection.

SUMMARY.

Isoamylhydrocupreine or eucupin, used in strengths of 1:1,000 to 1:500 for infiltration, in combination with procaine 1 per cent, and a proper proportion of epinephrine, 1:1,000 solution, appears to be a valuable aid in the practice of rhinolaryngology, for the reason that it affords most local tonsillectomy patients comparative or complete freedom from immediate postoperative pain, and a period of analgesia lasting at least 24 hours postoperatively. It is of low toxicity, and idiosyncrasy to its use is uncommon. It deserves a trial in the hands of careful observers.

39 East 50th Street.

A CLINICAL NOTE ON THE TREATMENT OF CHRONIC SUPPURATIVE OTITIS MEDIA.*

DR. ROBIN HARRIS, Jackson, Miss.

Mechanical cleansing of the recesses of the middle ear in chronic suppurative otitis media is *always* impossible, and the procedure is painful. In my experience the use of antiseptics is not only useless, but gives one the feeling that something is being done for the patient when the doctor is only "fooling himself"—a false sense of security—so to speak.

Mertins,[1] in a masterly article, has recently published his experience with urea solution as a solvent for proteins and dead tissue. The idea appears to be an improvement over any of the old methods of antiseptics and powders, and irrigations and vaccines. If all of the dead tissue in a chronic suppurating ear could be dissolved, digested or cleaned away, the majority of these cases would get well.

For some years I have used the powdered extract of Carica Papaya in solution as a digestant of the dead tissue present in chronically suppurating ears. This method has given me my best results in treating such ears. With the patient prone and the bad ear toward the ceiling, 3 drops of glycerine are placed in a medicine glass, together with 2 or 3 cc. (two droppers) of water and a measure (about 15 gr.) of the above named powder; mix quickly with a metal applicator and instill enough to be plainly seen in the canal. After one or two minutes, dry with cotton. Repeat this procedure once or twice a week. Occasionally there will be a lot of redness and swelling for a few days. I wait until this has entirely subsided before repeating the treatment. The solution deteriorates in five minutes; therefore, one must not lose time in making the application after the solution is prepared.

A case in point is that of a young man, age 19 years, who came to me Dec. 6, 1937. His mother and father stated that he had had a discharge of pus from the left ear all of his life. Fifteen months before his twin brother had died of

*Read at the Meeting of the Southern Section of the American Laryngological, Rhinological and Otological Society, Inc., Jan. 24, 1938.

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meningitis or some such complication following ear trouble of a similar nature. There was a large perforation in the ear drum far back and continuous with the posterior canal wall. A medium sized polyp was protruding from this perforation. Since he lives 75 miles away, treatment was outlined for him to use at home, and he was told to return in two weeks. After the two weeks' period no apparent improvement was noted except that the discharge was more profuse than it had been since he began treatment. On Jan. 19, 1938, the ear was dry, and there were no signs of a polyp ever having been present.

REFERENCES.

1. *Arch. Otolaryngol.*, Vol. 26, No. 5, Nov., 1937.

Medical Clinic.

DEMONSTRATION OF MICROSCOPICALLY PROVEN EPITHELIOMAS OF THE LARYNX TREATED AT THE PRESBYTERIAN HOSPITAL, OF NEW YORK, DURING 1931 and 1932.*

DR. MAURICE LENZ, New York.

Case 1: S. I., female, age 60 years, with a postcricoid epithelioma, the upper border of which was seen on direct laryngoscopy, and the lower limit visualized on a lateral radiograph, came in because of difficulty in swallowing. She was treated from March 21, 1932, to May 21, 1932, by daily X-ray treatments, with complete disappearance of symptoms. She remained well up to the middle of 1936, when she again complained of difficulty in swallowing, again showed an increased prevertebral shadow radiographically, and was given a second similar course of X-ray therapy, with complete relief of symptoms up to the present. This case emphasizes the need for radiographic help to demonstrate the lower extent of the disease in postcricoid epitheliomas and illustrates the tolerance of the normal tissues to a second full course of X-ray therapy. It should be mentioned, however, that there was an interval of four years. While she is free from symptoms at present, the X-ray film again shows an increase in the prevertebral shadow, so that she may have a recurrence.

Case 2: H. R. H., male, age 47 years, with an exuberant mass in the glossoepiglottic sulcus, which, on microscopic examination, showed an undifferentiated epithelioma, was treated by daily X-ray treatment from Oct. 3, 1932, to Oct. 19, 1932. He does not have any evidence of disease at the present time.

Case 3: A male, age about 59 years, complained of dysphagia over six months and hoarseness for one month. On examination, he had a moderately differentiated epithelioma of the left false cord, slightly fixing the left larynx, and a 3 cm. clinically metastatic mass of nodes in the left carotid

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region. He was treated from Nov. 12, 1931, to Dec. 14, 1931, with daily X-ray treatments and at present is free from clinical evidence of disease.

Case 4: A male, age 51 years, had a differentiated epithelioma occupying the anterior third of the right cord. He was given daily X-ray treatments from Oct. 6, 1932, to Oct. 25, 1932, has no evidence of disease at present and his voice is good. Four months following the Roentgentherapy, there was so much thickening of the cord that the possibility of a recurrence was considered until a negative biopsy proved this fear groundless. The telangiectasia of the irradiated skin of the neck, which he presents no longer, occurs in our more recent cases; it was caused by the larger total, and especially larger daily, dosage given in the earlier patients.

Case 5: A male, age 60 years, had an undifferentiated epithelioma occupying the anterior half of the true cord. He was given daily X-ray treatments from Aug. 24, 1932 to Oct. 1, 1932, shows no evidence of disease at the present time and his voice is perfect.

I have purposely abstained from giving details of the X-ray treatments as they are of no interest to laryngologists, while radiologists may find a detailed description of these cases in my publication jointly with the late Dr. Coakley and Dr. Stout in the *American Journal of Roentgenology,* Vol. XXXII, No. 4:500-507, Oct. 1934.

180 Ft. Washington Avenue.

ACUTE SYPHILIS OF THE INTERNAL EAR. AN INTERESTING CASE REPORT.

DR. SIMON L. RUSKIN and DR. GEORGE H. HYSLOP,
New York.

The widespread occurrence of syphilis and its possible relationship to traumatic injuries makes it important that a differential diagnosis of syphilis of the internal ear be made in all cases where progressive deafness is claimed as a result of head injury. This is all the more significant since the symptomatology of syphilis of the ear resembles in many respects that of cerebral concussion, thus in both instances one finds headache, dizziness, nausea and at times vomiting. When, in the subsequent days, impaired hearing develops, the tendency to attribute the ear symptom to the traumatic injury is taken as a matter of course without due differentiation of the lesion.

Syphilitic involvement of the labyrinth is usually a late manifestation of the disease, yet it can appear acutely, and Politzer has reported a case appearing on the seventh day after the primary lesion appeared. It may precede all other general manifestations of syphilis, and may occur as the only symptom of a venereal infection. It can be localized in the internal ear or may appear simultaneously with a catarrhal or purulent middle ear inflammation. The frequency of syphilis of the labyrinth has been estimated at from 7-48 per cent.

Moss (*Virch. Arch.*, Vol. 7x, p. 313) reported the case of a syphilitic individual, age 37 years, in whom marked subjective noises, attacks of dizziness and headache suddenly appeared, which were later followed by disturbances of hearing. At autopsy he found small cell infiltration of the connective tissue between the bony and membranous canals and in Corti's organ. Kipp (quoted by Politzer) likewise describes syphilis of the labyrinth as often appearing suddenly with subjective noises, dizziness, disturbances of equilibrium and marked deafness. The subjective noises may continue uninterruptedly, even after the deafness has become complete, while the dizziness and disturbances of coordination may disappear

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within a few months. Moos and Strinbrigge (*Zeitsch. fur. Ohrenh.*, Vol. xiv) have noticed sensations of pain in the ear which could be traced to a periosteal growth in the labyrinth. The course of syphilis may be characterized by a rapid development of disturbances of hearing. Politzer has seen cases in which the deafness was almost complete on the third day after the beginning of the impairment in hearing. The hardness of hearing may develop gradually or stay stationary for some time until after weeks or months a sudden change for the worse takes place. At times moderate head trauma is able to bring about a marked change for the worse.

The diagnosis of syphilis of the labyrinth may be made with certainty if symptoms of primary or secondary syphilis are present, and if the disturbances of hearing develop rapidly with the luetic symptoms, particularly when associated with the loss of hearing by bone conduction, which may precede all other indications of lues. Another reliable sign of syphilitic involvement of the labyrinth, according to Alexander, is the abnormality in the reflex irritability of the static labyrinth, whereby there occurs a loss of reaction to rotation and a retention of reaction to caloric irritation, or less frequently vice versa. An additional characteristic finding in the functional testing of luetics is the diminished reaction of nystagmus, or vestibular vertigo.

The case here reported is of especial interest because it demonstrates the similarity in symptomatology between syphilis of the ear and a minor head injury, and the care that must be taken in differential diagnosis.

The patient, P. R., age 40 years, first appeared at my office on Sept. 8, 1937, accompanied by his family physician, Dr. Joseph Bronstein, of 200 Dyckman street, New York City. He gave a history of having been struck on the head behind the right ear by a flying piece of stone about the size of a fist, and that at the time of the injury he fell into the ditch where he was working. The patient was not unconscious. He got up and went to Dr. Bronstein for treatment. He walked into my office a few hours after the accident. At that time he complained of some pain in the region of the right ear, headache, some vertigo and nausea.

Examination revealed a small superficial abrasion of the skin over the right mastoid region and a small abrasion in the outer third of the external auditory canal, at the posterior inferior angle. There was no evidence of rupture of the drum membrane, nor any sign of bleeding into the middle ear. The right drum membrane was moderately opaque and not retracted. Examination of the scalp showed a 2-inch healed scar at the midline anterior to the vertex, attributed to bayonet wound received in the Army service 20 years previously.

Tuning fork test revealed hearing by air and bone conduction on both sides, although he said the hearing by air conduction on the right side was less than that on the left; nevertheless, there was no question of total loss of hearing. This was tested in the presence of his physician.

Rotation tests performed at that time showed practically equal response on both sides. There was no spontaneous nystagmus; there was an indefinite swaying, but not true vestibular falling, and no spontaneous pastpointing, thus justifying the diagnosis of no injury to the inner ear. No caloric test was performed because of a history of recent ear injury.

X-ray of the skull was negative for fracture.

The patient reappeared for examination on Sept. 25, 1937, complaining of difficulty in hearing in the right ear, pain in the region of the right ear, a sensation of falling on lifting the head back and slight tearing from the right eye. Functional testing of the ear at this time disclosed a loss of caloric reaction on the right ear, although his reaction to rotation still remained within normal limits. The rotation test was repeatedly performed with equal results for both sides with the exception of one test, when there was a difference, slightly higher than previously, between the two sides. Hearing tests also showed a greater loss than when originally tested. Since the hearing test is a subjective one, it was somewhat difficult to evaluate it completely. The absence of the caloric reaction on the right side was not associated with any acute manifestations of labyrinth irritation, such as spontaneous nystagmus, spontaneous pastpointing or spontaneous falling.

It seemed strange that between Sept. 8 and Sept. 25 such a pronounced change in the inner ear function should have occurred without any of the acute manifestations of labyrinthine injury.

The insidious appearance of the ear condition presenting symptoms of headache and vertigo and impairment of hearing seemed like a continuation of the acute symptoms associated with the injury received from the flying piece of stone; however, the paradoxical loss of caloric reaction associated with the retention of the reaction to rotation and marked loss of bone conduction pointed to a syphilitic inner ear lesion. It was all the more difficult to correlate these findings with the examination at the time of the injury, which showed relatively good hearing. The question arose as to whether this patient had sustained an involvement of his inner ear between

Sept. 8 and Sept. 25. The aural examination on the latter date showed definite evidence of a syphilitic inner ear disease.

Since it is known that syphilitic labyrinthitis can precede all other general manifestations of syphilis as shown by Politzer, and may appear within seven days of the onset of the disease, the possibility that the patient acquired a syphilitic inner ear disease in no way related to the traumatic injury required investigation.

Early in October the patient observed what he described as a small pimple on the glans penis. His last previous sexual intercourse was in June. Scratching of this lesion caused a secondary inflammation, resulting in marked swelling of the penis, found when he was admitted to hospital on Oct. 28. Dark field examination of the sore of the penis was positive for Spirocheta Pallida, and his Blood Wassermann reaction was 4+ to both antigens, thus substantiating the diagnosis of syphilis of the labyrinth. The spinal fluid protein was increased, there were two cells, Wassermann was negative, and the gold curve was 111,000,000.

Neurological examinations by Dr. Hyslop on Sept. 19 and 25 were negative except for decrease of the right abdominal reflexes.

In December, 1936, the patient again appeared for neurological examination by Dr. Hyslop. He reported that he had completed a course of five intravenous and six intramuscular injections for his syphilis and having had an operation for relief of the inflammatory involvement of his penis.

The patient stated that the secondary syphilitic facial eruption which was present at the time of his previous examination by Dr. Hyslop in November had cleared up promptly. The patient said that he still complained of vertigo on looking upward, and a tendency to fall to the right in walking or on making turning movements. In addition, he said that he had lost his hearing in the right ear, although he insisted that his acuity in the left ear is normal. This was at variance with the audiometer findings, which showed bilateral deafness. He still complained of some tearing from the right eye and that the right eyelids tended to close during the act of chewing.

Complete neurological examination at this time, and an incomplete neurological examination in January failed to reveal any signs of organic involvement of the central nervous system other than that referrable to the auditory and vestibular mechanisms. The patient showed no abnormality of eye movement or function of the eyelid, although he displayed to the examiner the symptoms which he said occurred on occasion.

The patient showed no impairment of equilibrium on change of position when he was not under direct testing. On direct testing he swayed to the right and backward in the Romberg position, but performed the finger to nose test in this position without such swaying.

A right sided diminished sensibility to pain and vibratory stimuli was claimed up to the level of the shoulder and the patient asserted that there was diminished sensibility in the right temple and forehead. The corneal reflexes were not impaired, thus showing that the claimed decreased sensibility in the face was not based on physical cause. There was a slight lag of the lips, but the perfectly normal movement of other

facial muscles on the right side and no apparent right asymmetry at rest indicated that the lag was not due to facial nerve weakness.

On routine test of hearing there was an apparent impairment in both ears, with seemingly a loss of air conduction in the right ear. The patient claimed normal hearing on the left, but tests showed deafness. Bone conduction in the right ear was practically lost and sound was lateralized to the left on the Weber test. There was no evidence of conjunctival inflammation or lacrimation in the right eye.

A summary of Dr. Hyslop's opinion was that there was no physical disability at the present time due to injury, and that the syphilitic ear disease could be responsible for the claimed hearing defect and vertigo. The patient's complaints of tearing from the right eye and of various sensory and motor symptoms related to the right trigeminal nerve and eyelid muscles had persisted for several months, but hospital observation in October did not corroborate the patient's claim in these regards. However, by February, 1937, the patient showed definite facial nerve weakness, and certain abnormal associated eye movements in chewing and swallowing. Subsequently, the patient showed progressive loss of hearing on the right side, so that now it is not possible to elicit any evidence of hearing on the right side. The left side shows a marked shortening of the upper tone level, indicating a bilateral process effecting both inner ears characteristically syphilitic.

This case report is of particular interest since the diagnosis of syphilis of the right inner ear suggested itself prior to the appearance of the general manifestations of syphilis, concurrently with, or preceding, the appearance of the chancre. Further, within four months the right facial nerve was objectively involved and deafness was bilateral. The increased spinal fluid protein indicated early neurosyphilis.

The patient has continued anti-syphilitic treatment during nine months without recovery from the condition described in this paper.

SUMMARY.

Symptoms of syphilitic involvement of the inner ear resembling in character those of traumatic head injury and being differentiated primarily by labyrinth testing, showing a paradoxical relationship between the rotation and the caloric tests, on which basis the inner ear lesion was diagnosed as luetic rather than traumatic.

Substantiation of the diagnosis of syphilis of the inner ear by subsequent general manifestation of the disease, positive Wassermann and observance of the Spirocheta Pallida by dark-field examination.

The question further arises as to whether a traumatic injury to the head could hasten the appearance of symptoms of luetic ear involvement and what relationship the injury would bear towards the degree of loss in hearing. In view of the fact that syphilitic involvement of the ear is, as a rule, a progressive disease leading frequently to eventual total deafness, one must view the total loss of hearing as the manifestation of the syphilitic process.

The rate of this loss of hearing would ordinarily be so problematic that one could hardly argue any specific increment to the associated injury. In this particular case, however, it would appear that the patient had acquired his syphilitic disease prior to the time of his accident, and that his syphilitic labyrinthitis was confused with the accident because of time relationship.

351 West 86th Street.

129 East 69th Street.

A NEW INSTRUMENT FOR SUCTION-IRRIGATION IN THE TREATMENT OF PARANASAL SINUSITIS.

DR. JOHN J. GURTOV, New York.

Of the various methods in vogue for the treatment of purulent paranasal sinusitis, suction-irrigation is, in my opinion, the most effective. Although there are numerous devices in use for this purpose, they are not without shortcomings. The instrument here described is designed to eliminate the prevailing defects.

Essentially, it is a double return-flow instrument which can be applied to both nares at the same time. It consists of two U-shaped tubes; one (B), the shorter and of larger diameter, into which a longer tube (C) of smaller diameter, is concentrically fitted. At each end of tube (B) there is a cone-shaped nasal tip (A). At each side of tube (C) near its connection with (B), there is a valve for the purpose of shutting off either side in case it is desired to treat only one side of the nose. The irrigating solution enters the nose by gravity from a receptacle (placed about 6 feet above the floor), which is connected by a rubber tube to faucet (E) at the convexity of (C). The suction is accomplished through a fitting at the convexity of (B), which is connected by a rubber tube to the waste bottle, which, in turn, is connected with the suction pump.

To use the instrument most advantageously it is best to have the patient seated at the left of a sink-basin, the receptacle for the solution and the suction pump placed at its right, the surgeon or nurse standing in front of the basin. The instrument now properly connected, faucet (E) is opened to allow some of the solution to run out of the instrument before it is placed in the nose. Valve (E) is momentarily shut off, the suction pump is then set going, the instrument inserted into the nose, valve (E) is opened again, while the patient leans forward with the head bent somewhat downward and the mouth wide open. A little familiarity with these details will help to obtain the best results.

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The advantages of this instrument are:

1. It can be applied to both nares at the same time.

2. A valve on each side makes it possible to treat one side of the nose when desired.

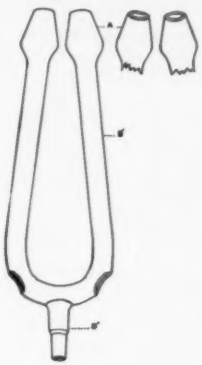

Fig. 1.

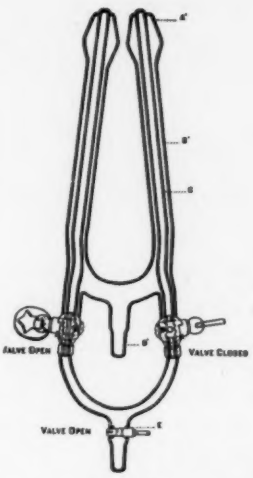

Fig. 2.

This instrument is manufactured by E. B. Meyrowitz, Inc., New York.

3. The nasal tips are so fashioned as to prevent the nares from becoming airtight; and this, with other features of the design, eliminates the disagreeable reaction associated with other forms of suction-irrigation, such as gagging, irritation of the eyes, shooting pain from the nose into the head, etc.

4. It is well tolerated by the most nervous patients and is of particular value in the treatment of children, who may be coaxed into holding the instrument themselves so as to win their co-operation; thus the most refractory class of patients can be easily managed.

3235 Grand Concourse.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTO-LARYNGOLOGY.

Meeting of Jan. 19, 1938.

Demonstration of Microscopically Proven Epitheliomas of the Larynx Treated at the Presbyterian Hospital of New York During 1931-1932. Dr. Maurice Lenz.

(Published in full in this issue of THE LARYNGOSCOPE.*)*

Salivary Fistula Following Mastoid Operation. Two Cured Cases. Dr. Edwin B. Bilchick.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Chondroma of the Lung. Report of a Case. Dr. A. J. Cracovaner.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

An Unusual Case of Lymphoepithelioma of the Nasopharynx. Dr. George E. Bradford.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Multiple Myeloma Involving the Temporal Bone. Dr. E. P. Fowler, Jr.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Epistaxis from Telangiectases, Treated by Quinine Urethrane Injection. Dr. G. H. O'Kane (by invitation).

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Traumatic Rupture of the Trachea. Dr. George Worcester.

A case of traumatic rupture of the trachea is hereby presented. An Italian laborer, aged 42 years, was injured in the following manner: While backing out of a lift with a metallic wheelbarrow full of mortar, the lift suddenly ascended and the patient was struck in the back of the head and pushed forward against the sharp edge of the wheelbarrow, just below the larynx. It was immediately noted that he was severely injured and he was at once brought to Englewood Hospital, a distance of about eight miles; this was accomplished in about 15 minutes.

When examined in the accident room of the hospital, about 20 minutes after the accident, he was markedly cyanotic and dyspneic, and there was emphysema of the cervical region on both sides. There were small abrasions and contusions at the site of the injury, but no laceration. He was immediately taken to the operating room, and with no attempt whatsoever at anesthesia or antisepsis, an incision was made in the midline. At this time the patient was practically moribund.

As the incision was carried deeply enough to reach the trachea, it was found that there was complete rupture of the trachea and the severed ends were approximately two inches apart. Suction was introduced into the lower segment of the trachea and about two ounces of free blood were aspirated. A Flagg anesthesia tube was inserted into the lower segment of the trachea, the wound packed with plain gauze to stop hemorrhage, and oxygen was administered for about one hour. Then the lower segment of the trachea was brought up and sutured to the skin edge near the lower angle of the incision and the larynx above was brought down and stitched in its posterior aspect to the lower tracheal segment. Iodoform gauze packing was placed laterally to the sutured trachea. At this time a bronchoscope was inserted into the lower segment of the trachea and it was found to be free of secretions.

The patient at this time was in fair condition. Infusions of glucose were administered daily for three days, at which time it was noted that the anterior aspect of the esophagus in the region of the tracheal rupture had also been

lacerated. A Levine tube was then inserted nasally into the stomach, and feedings were instituted through this tube.

Two attempts have been made to close the esophageal lacerations—unsuccessfully, however. The present condition of the patient generally is good. At the time of injury, his weight was 170 pounds; two weeks after injury it was 137 pounds, and now, seven weeks after injury, it is 145 pounds. Locally, the wound is clean and has contracted markedly, so that the distance between the ruptured ends of the trachea is only about three-quarters of an inch. The larynx has contracted and there is nearly a total atresia present.

The case presents the following problems: first, to close the esophageal fistula; and second, that of attempting to bring the ruptured edges of the trachea and larynx together. It is hoped to report later upon the success or failure of these two problems.

A New Double Bronchoscope. Dr. George R. Brighton.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

A Critique of the Treatment of Laryngeal Cancer. Dr. John D. Kernan.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. ROBERT E. BUCKLEY: Always when Dr. John Kernan talks we expect to hear something interesting. We certainly did tonight. I feel that, first of all, we must compliment him on the finesse and scientific attitude he takes on this question of cancer. It is a very difficult problem, of course, to attempt to evaluate the treatment of cancer. I believe that unless we are very careful, we are inclined to become biased as to what the treatment is, depending on what our treatment is. I think at the present time, unfortunately, that has happened in our city. To say that laryngectomy is antiquated now and will be unheard of in a year from now is absurd. Laryngectomy is not antiquated and will be heard from for many years to come, unless other methods of treatment are discovered. In this question of the treatment of cancer of the larynx, we all know that certain types of cancer at the present time cannot be handled in any way except by a laryngectomy if we wish to prolong life. I remember sitting with Dr. Lenz about a year ago and hearing the father of this modern treatment of cancer, Dr. Coutard, of Paris, says, "I have never seen a bound down cord that was cured by radium or X-ray." We see in our ordinary examination of the larynx a large group of cases in which the cord is bound down but the growth is nevertheless intrinsic, and which offer a potential hope of a fairly large percentage of cures or temporary relief over a long period of years. Certainly there are a large number of cases we see with a bound down cord, but still intrinsic, in which the laryngologist knows that a total removal of the larynx will offer a good chance of cure. If the same case is treated with X-ray or daium, we know that the percentage of cures will be hopelessly few. I, too, have heard that the term, laryngectomy, will soon pass out of our dictionaries. Personally, I doubt it.

On the other hand, there are certain types of laryngeal malignancies in which there are excellent results when treated by way of deep X-ray therapy. I think, whether you take the surgical side of the fence or the opposite, you must first consider if it is possible to cure the case with X-rays, or some type of radiation therapy. We must certainly give this a great deal of thought. I have been very much interested in Dr. Lenz' work in this field because I have to a certain degree co-operated with him by an exchange of cases, and I realize the type of work that can be done and is being done. I feel that the classification of cancers by way of their histology, the so-called Broder classification, which divides the growths into Types 1, 2, 3 and 4 the first two being supposedly radioresistant, and the latter two radiosensitive, does not have the same importance today as it was presumed to have a few years ago. The location of the growth, as I know Dr. Lenz is going to say later, is by far the most important factor. So, if we could all get together and forget that one does surgery and the other does radiotherapy, and could analyze what case is suited to this and what case is suited to that form of treatment, that is how the happiest results would be obtained.

As I said before, cases with a bound down cord do not give good results with X-ray therapy. They do with surgery. There is another group of cases, that group in which the epiglottis is involved, but the tissues surrounding the epiglottis are not infiltrated, in which surgery will not offer a good result, and in which I think X-ray therapy offers an excellent result. I think the important consideration in this particular group is that surgery is contraindicated because it seems so hopeless. Consequently and fortunately, treatment by irradiation is indicated immediately and, again fortunately, it does give results.

I have just cited two groups, one in which I think surgery is definitely indicated, and the second in which I think deep X-ray therapy is indicated. There is a third group, a very interesting group, of very early cancers of the cord proper, so frequently located in the middle third. What Dr. Kernan said must be true all over, because we have also noted in the past few years that cases come into the hospital today in which laryngofissure can be done, and outnumber those cases in which laryngectomy is indicated. At least in New York, I think, we have become cancer-conscious, in this group of cases. All of us know that the laryngofissure operation has been extremely successful. It is not a difficult operation. You see the growth, strip the cord and take out the growth. It is trivial and there is practically no mortality. The results are excellent. This, I think, is the most important point. This operation has been in existence for a great many years, always with these same results. I think the important point in evaluation here is in a consideration of these early cases. It must be a relative measure, as to how many cases have been cured from how many cases have been treated, one way against the other. I am not in a position to state how many have been cured by surgery, but I think in well selected cases it is a high percentage. I do not know the results but I think the results in radiated cases are also good. Time alone will tell to how great an extent radiation will be able to replace surgery.

Recently, I attended a meeting at Charlottesville of the University of Virginia. It was very interesting to note that down there they have been treating the extrinsic type of cancer cases by preliminary surgery (which we have also been doing here to some degree), with total removal of the larynx, etc., followed by deep X-ray therapy. The reason for this is that extensive irradiation, when not preceded by surgery, produced cartilage sloughing and frequent fatal respiratory infections. Therefore, surgery is done, not so much to cure the cancer but to eliminate the respiratory difficulties.

In closing, I feel that we ought to keep our feet on the ground. I think that radiation therapy has developed very rapidly in the past five years. I do not think it is yet at a point where it ought to be accepted too fast, and it certainly should not be condemned. I think we should watch the cases, think the thing over and talk it over, a sort of common sense method, and not get sold on either the one or the other.

Dr. Maurice Lenz: During the years 1931-1934, we treated a total of 47 cases of cancer of the larynx by X-ray therapy; 13 of these are at present free from evidence of disease. In addition to these 47 cases, we also treated two patients with persisting cancer in the tracheotomy opening following laryngectomy, and two other patients for cervical node metastases following laryngectomy. These last four patients are dead and are not included in the discussion of treatment of cancer of the larynx as the X-ray treatment was not given for their disease in the larynx.

All 47 patients had positive biopsies. They had dental attention and oral hygiene before X-ray treatment was started. The X-ray treatment consisted of daily exposures for four to five weeks of the region of the larynx through a left and right lateral neck field until each field had received a total dosage of, roughly, 3,000 radons with 200 Kv. X-ray, 50 cm. T.S.D., 2 c.mm. This usually caused the epithelium of the irradiated mucosa to shed and to become covered by a pseudodiphtheritic membrane. During this period of acute reaction we hospitalized many of the patients to prevent dehydration, which may occur because of the accompanying dysphagia and reduced drinking. There were no cases of pneumonia except where cancer persisted locally and where a tracheotomy was present. Tracheotomy was done in 18 patients, in 11 before the X-ray treatment (seven were laryngectomies) and in seven after treatment; in six of the latter it had to be done because of obstruction

by uncontrolled cancer. In the seventh, it was an emergency procedure directly attributable to the treatment. Necrosis of the cartilage and gangrene of all laryngeal structures caused death in this patient. There was only one other patient who had necrosis of the laryngeal cartilage resulting from the treatment. He had a midline neck cyst—probably a thyroglossal cyst. The cyst broke down when the radiation reaction of the skin was at its height, and the epidermis was sloughing. The breaking down of the cyst may have extended to the cartilage; six months later, there was chondronecrosis of the laryngeal cartilage, followed by death of the patient. In several cases, especially where treatment consisted of 350 radons or more daily and where the fields used were large, there was persisting edema of the arytenoids, and in two cases slight permanent thickening of the true vocal cord. When the 47 cases are analyzed according to the assumed primary site or predominating location of the disease, we find the following survival:

CARCINOMA OF LARYNX TREATED BY X-RAY THERAPY, PRESBYTERIAN HOSPITAL, 1931-1934 (INCLUSIVE).

Assumed Primary Site; Predominant Location	Total No.	Treated by X-ray Alone	No. Prec. by Surgery	SYMPTOM-FREE	
				X-ray Alone	Preced. Surgery
True cord (extens., 13; small, 2)	15	11	4(3 L)	2	3
Band	4	4		1	
Sublottic	3	1	2(1 T) (1 L)		
Arytenoid and aryepiglottic fold	12	10	2(L)	1	1
Pyriform sinus	2	1	1(L)		
Postcricoid	1	1			
Epiglottis and glossoepiglottic fold	9	9		5	
Undetermined	1		1(L)		

L—laryngoctomy; T—thyrotomy.

On the basis of the above facts, we have drawn the following conclusions: Curability of cancer of the larynx by X-ray therapy depends on: 1. Extent and clinical form; that is, small and exuberating lesions are more favorable than large and infiltrating types. 2. Anatomic localization: a. Cases which have done best have been those arising in the epiglottis and glossoepiglottic fold. b. Small epitheliomas limited to one cord, not extending across the anterior or posterior commissure may do well by X-ray therapy alone, as exemplified by the two patients presented. Where the tumor originating on the true cord is larger and fixes the cord, the cases have not done well with X-ray therapy except if this treatment was given as a postlaryngectomy measure. Fear of necrosis of the laryngeal cartilage has prevented us from administering full dosage in those cases which were irradiated after partial resection of the cartilage and we advise against partial resection of the cartilage if X-ray therapy is to be used. For similar reasons, tracheotomy, if indicated, should be done below the field of irradiation and preferably before treatment is begun. c. Epitheliomas arising on the bands are best treated by X-ray therapy alone. Though only one of the four cases arising on the band was arrested for five years, the other three were temporarily controlled, one for over three years. d. X-ray therapy is only rarely successful in arresting epitheliomas arising in the arytenoid region. Of the 12 such cases in our series, two are well without evidence of disease. One was preceded by laryngectomy. 3. Histologic grading was only of moderate help in estimating radiocurability and the first two factors mentioned seemed to be of greater importance. 4. The tax on the patient's general health in this treatment was so great that only those in fairly good general condition were able to stand full dosage. Radiation dosage was best guided by daily observation of the larynx and study of the general condition of the patient and could not be outlined satisfactorily in advance.

DR. JOHN D. KERNAN: I would just like to thank these gentlemen for their discussions and say that the purpose for which I brought up the discussion has been answered.

BOOK REVIEW.

The Basis of Tissue Evolution and Pathogenesis. By Albert A. Gray, M.D., C.R.S.E., formerly Lecturer on Diseases of the Ear, Glasgow University; President, Section of Otology, Royal Society of Medicine, 1914-1916; President, Section of Otology, British Medical Association, 1922; President of the Collegium Otolaryngolicum, London, 1929. Author of "The Labyrinth of Animals," "The Ear and Its Diseases," "Otosclerosis," "Atlas of Otology," etc. Glasgow: Jackson, Son & Co., Publishers to the University, 1937; 92 pages with Index and seven illustrations. Price, 7/6 net.

Dr. Gray set forth the theory that the evolution of a tissue, a structure, or an organ is the result of induced variation, that is variation induced by the repair which follows any minute injury. By injury the author did not mean merely gross mechanical injury, but includes the damage inflicted by chemical agents, poisons, and physical conditions such as dryness, moisture, heat and cold. He believed that changes of environment cause injury; injury is followed by repair; and the process of repair gives the opportunity for variations to occur which leaves the tissue better equipped to withstand the changed environment.

The form of repair which is adopted is that form which is best suited to resist the injury when it is again sustained. Thus, the animals which possess this power have an advantage in survival over their fellows. These animals, male and female, when they mate, will produce offspring which on the average will have the potentiality for producing such a form of repair in considerably stronger degree than either of their parents, and such repair will be reproduced more easily, that is, by a slighter degree of the same injury. Natural selection again acts upon the survivors of that generation and eliminates those which are least able to produce this result satisfactorily and quickly, so on with each succeeding generation the potentiality inherent in the fertilized ovum becomes stronger and stronger, until no injury is necessary to bring about its occurrence.

In the evolutionary process, the multicellular animal probably began as a mass of unicellular organisms, which, instead of separating from one another at the time of the division of the mother cells, remained in more or less close contact. These cells had the same appearance and were possessed of the same qualities, but they were not absolutely identical. As a result of these minute differences, certain of the cells offered a slightly greater resistance to some possibly injurious constituent, chemical or physical, in the medium in which they lived, and the outer layer of the mass came ultimately to be composed of cells possessing this resistance. Some of the cells in the centre having this potentiality were able to take over the function of the outer layer. This is exactly what happens when a wound on an epithelial surface is healed.

The more accepted theory of spontaneous variation holds that evolutionary changes came about by chance and that the supply of the new tissue preceded the demand by the environment. Gray maintains that the demand came first and caused the supply to be evolved. He gives as an example the development of the forelimbs of the amphibians. Gray believed that it was due to a change of environment—a marsh or shallow lake dried up. The responses to the wear and tear, and altered stresses and strains were changes in the component tissues—the skin, cartilage and joint surfaces. In following generations, the amount of injury necessary became less and less, until a generation came forth in which the changes appeared without any injury.

This account may appear to be supporting the theory of transmission of acquired or impressed characteristics, but such is not the case. The new character is not transmitted but the potentiality of acquiring it is. Ultimately,

this potentiality becomes more and more reinforced until it becomes so strong as to produce the new tissue or structure; henceforth, what was originally a process of repair becomes a feature of normal development.

The transition of the skeleton from cartilage to bone was induced in like manner. When certain fish were compelled to leave the water, the stress which fell upon the various structures was very great. Such injury meant that repair was necessary. It was achieved by some cells having the faculty of depositing mineral salts about them and replacing the cartilage cells. It would have been unsatisfactory if the skeletal structures throughout the body were united into one rigid mass; therefore, some pliable portions of cartilage or connective tissue remained during the process, and we have an induced bony skeleton with joints, etc.

Further proof of this theory of growth through injury is found in the fact that muscles will remain small and feebly developed unless they be put to use. A bone will not reach its full normal anatomical proportions unless the muscles to which it is attached are used. In other words, although the potentiality in the ovum will evolve the structures up to a certain point, there is still required the final condition of injury, for, of course, use necessitates injury to the cells.

The entire process can be seen in the ordinary healing that follows a wound. The process of the repair of a wound is an epitome of the process of the differentiation of tissues in the evolution of the race—so our author believed.

It must be remembered that changes in one structure of the body almost invariably necessitate changes in some other parts of the body. The most frequently occurring complementary change occurs in the blood supply. Injury to a living tissue is associated with an increased supply of blood to that tissue. This is necessary both for the removal of the injurious products and also for the increased supply of nourishment required by the cells for the process of repair. It is not difficult to realize that just as in succeeding generations the tissue became so adapted to the injury that the injury became the normal stimulus, so does the vasomotor response become the response to the normal stimulus.

Gray pointed out these changes, using the labyrinth as an example. The story of the evolution of the cochlea is comparatively simple. It is not present in fish but makes its first appearance in some of the amphibia. There is no evidence of retrograde changes in the developmental history. This may be readily understood when it is remembered that sound waves can reach the animal whether it lives in the air, in water, on the earth or under it. Accompanying this evolution of the cochlea there is the concomitant evolution of the blood vessels upon which the nutrition of the organ depends; also, there is the associated evolution of the vasomotor reflexes which cause dilatation or constriction of the organ whether actually functioning or at rest.

The evolutionary history of the semicircular canal is in striking contrast with that of the cochlea. In the fish, they reach a degree of development which is never surpassed in the other verterbrate animals. In tailless amphibia, frogs and toads, the semicircular canals show a poor degree of development both as regards size and nerve supply. A greater degree of development is found in the reptiles, and in the labyrinth of birds the canals show a remarkable high state. In mammals, they reach a fairly high standard, though far short of that found in fish and birds.

The blood supply of the semicircular canals and the vasomotor control of the blood develops with the structure and functional activity of the organ and where the canals undergo retrograde changes, so, also, do similar retrograde changes occur in the blood vessels and the neurones of the vasomotor system which regulate the calibre of the blood vessels.

There remains but one more test of this hypothesis, and that is the applicability of the theory in explaining pathological processes. The author has chosen to explain hereditary pathologies. He divided these into two groups:

first, those which are present from the very beginning; and second, those arising late in life after the organs or structures have functioned normally for many years. As an example of the former type he chose what he called deafmutism, and of the latter, otosclerosis.

The first type is easily explained: If in the fertilized ovum the genes are defective in number, arrangement or quality, the structure cannot develop in a normal way.

As regards the second type, or those which make their appearance after many years of normal physiological activity, the author offers the suggestion that they are the result of a defect in the vascular supply of the tissue or organ concerned. His reasons are as follows: Both the structure which serves a given function and the mechanism which governs its nourishment are inherited qualities; however, Gray believed a different set of genes are concerned in each element. It is quite possible, therefore, to have two different types of inherited pathological conditions: those in which the defect lies primarily in the actual structure and those in which the defect lies primarily in the nutritional mechanism.

Postmortem examinations bear out this belief. In the instance of deafmutism, evidence is found of defects that would prevent the cochlea from functioning in the normal way. In otosclerosis, except in the very late stages, the structure in the cochlea show no departure from the normal; however, there is definite proof that the vasomotor response is either absent or sluggish.

The question may arise: "If these vasomotor defects associated with otosclerosis are inherited and, therefore, present in the fertilized ovum, why are they not revealed at birth?" The author admits that he knows of no positive answer. He guesses at two possible reasons. First, that the defect only comes into existence after the causative factor has been in operation for a long time; and secondly, that they are influenced to a considerable extent by environmental conditions. That is, the defect is potentially present at birth, but a further injury is necessary to start its destructive process.

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